COMPREHENSIVE GROUND WATER MONITORING EVALUATION

OF

GENERAL MOTORS CORPORATION - INLAND FISHER GUIDE DIVISION

ELYRIA, OHIO

LORAIN COUNTY

OHD004201091

OHIO ENVIRONMENTAL PROTECTION AGENCY

MARCH, 30 1990

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I. GENERAL INFORMATION

Purpose

The purpose of this report is to document the results of a Comprehensive Ground Water Monitoring Evaluation (CME) conducted at GMC Inland Fisher Guide Division, Elyria, Ohio. A CME is an in-depth evaluation of the adequacy of a facility's ground water monitoring network with regard to the Administrative code rules 3745-65-90 through 3745-65-94.

CME Inspection

The inspection was conducted on February 21, 1990 by Ahmed A. Mustafa, Ohio EPA, Division of Ground Water (DGW), Northeast District Office (NEDO). The following parties were present at the site:

* Lowell W. Metzger	: OHM,Inc.
* Mark Martin	: OHM,Inc.
* Al Longoria	: OHM,Inc.

The results of the inspection are presented within the content of this CME report and Appendix A checklists.

It should be noted that parts of the previous 1987 CME report for this site completed by Jan (DeLorenzo) Carlson of the Division of Ground Water, (DGW), Ohio EPA, were incorporated into this CME report directly without modification. Therefore, I would give credit to Jan Carlson for using some of her work as part of this CME.

Information Sources

This report is based upon an extensive record review. In addition to the Ohio Environmental Protection Agency (Ohio EPA) files and information gathered from observations made by Don Easterling during the inspections that were made since the previous CME, the following documents provided information upon which this report is based:

1. Part B Permit Application of November 8, 1985.

2. Ground Water Quality Assessment Plan Phase 2, May and June 1987, Roy F. Weston, Inc.

3. Closure Plan Hazardous Waste Management Facility, Fisher Guide Division, General Motors Corporation, Elyria, Ohio Plant, May 1987.

4. Comprehensive Monitoring Evaluation, General Motors Corporation - Fisher Guide Division, Elyria, Ohio, September 28, 1987, Ohio EPA.

5. Supplementary Annual Ground Water Reports for 1982, 1983, 1984, 1985, 1986, 1987 AND 1988.

6. Ground Water Quality Assessment Plan Phase 2 Final, December 1987, Roy F. Weston, Inc.

7. Part B - Post Closure Permit Application of November 8, 1988.

8. Geology of Water in Ohio, Bull. 44, 1943, W. Stout, K.V. Steeg, and G.F. Lamb, Ohio Department of Natural Resources; G. W. White, Ohio Department of Natural Resources (ODNR).

9. Glacial Geology of Northeastern Ohio, Bull 68, 1982, G. W. White, Ohio Department of Natural Resources (ODNR).

10. Ground Water Resources of Lorain County, 1980, Glenn W. Hartzell, Ohio Department of Natural Resources (ODNR).

11. Ground Water Pollution Potential of Lorain County, 1988, Douglas J. Barber, ODNR.

Inspection Checklists

Attached to this report are several checklists from the Interim Status Ground Water Monitoring Program Evaluation (SW-954). The checklists deemed appropriate for this facility are:

APPENDIX A: COMPREHENSIVE GROUND WATER MONITORING EVALUATION WORK SHEET

APPENDIX A-1: FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND WATER MONITORING

II. SITE HISTORY AND OPERATIONS

Facility Name: General Motors Corporation - Fisher Guide Division, Elyria, Ohio

EPA I.D. Number: OHD004201091

Facility Location:

The General Motors Corporation (GMC), Fisher Guide Division is located in Lorain County, Ohio, at 1400 Lowell Street, in the City of Elyria. The plant is situated at the northern outskirts of the City of Elyria in the midst of a rural and residential setting. Figure 1 depicts the site location of the GMC Fisher Guide Division.

Facility Description

The GMC-Fisher Guide Plant manufactured approximately 1,600 automotive component parts for General Motors vehicles according to the Part B Application of 1985. These parts include assorted plastic and metal automotive hardware, plastic interior/exterior trim, urethane foam seat backs, cushions, and arm rests. The processes involved in these manufacturing activities include machining, stamping, phosphating, chromic acid rinsing, forming and welding of metal parts, metal coating, prime/finish painting, thermoforming and injection molding of thermoplastic parts, and foam molding. The facility site plan is depicted in Figure 2. All plant manufacturing and operation, which started in 1952, was ceased in July 1988. However, in April 1988, GMC had requested an extension to complete the closure plan. In July 1988, the facility was granted an extension on their closure plan until August 31, 1988. The plant and the immediate surrounding property, is to be sold as parcel A and B according to the Part B - Post Closure Permit of November 8, 1988. It was noted during the CME inspection that Parcel A was sold to Steve Rosen through Manner Auctioneers of California who bought the plant from GMC. GMC Fisher is the present owner of the Landfill area and Parcel B. Mr. Philip P. Kienle, Environmental Engineer, is GMC contact for Parcel B, the landfill and in dealing with the Ohio EPA.

Waste Materials Generated and Disposal Practices

Waste material that was generated at the GMC-Fisher Guide Plant includes electroplating wastes (EPA Hazardous Waste Code F006) and the chemically stabilized sludge-like materials resulting from CHEMFIX ^{R} process treatment of the wastes. The CHEMFIX ^{R} product was a chemically and physically stable solid with characteristics similar to that of a 'clay soil'.

Fisher Guide operated its own wastewater treatment facility at the Elyria Plant to treat all process wastewater from plant operations. Wastewater treatment included hexavalent chrome reduction, pH adjustment, metals precipitation, water/solids separation, sludge dewatering, oil emulsion breaking, and oil/water separation. The effluent from the wastewater treatment operation was discharged to a storm sewer, and was regulated under NPDES permit #3IS001*CD (reference #3). No wastes from outside sources were accepted for treatment, storage, or disposal at this facility.

According to the Part B Application of 1985, the wastewater treatment plant also incorporated two open concrete tanks for the purpose of decontaminating inactive production equipment. Demolished piping, tank, and assorted plating equipment were occasionally placed in these tanks for the purpose of rinsing them prior to disposal. The rinse water from this decontamination process was directed into the wastewater treatment facility. The decontamination tanks were considered part of the wastewater treatment process and were regulated under the Clean Water Act.

The wastewater treatment facility also included three sludge dewatering impoundments that were located south of the manufacturing building. These impoundments were used to dewater metal hydroxide wastewater treatment sludge (F006 U.S. EPA Waste ID Code) resulting from electroplating operations. As of July 31, 1984, the Elyria plant discontinued the majority of its electroplating operations. According to the Closure Plan (April 1984), this change effectively reduced the sludge loading of the wastewater treatment plant to the extent that sludge dewatering could be accomplished by means other than the dewatering impoundments. Consequently, in September 1986, GMC, Fisher Guide had pursued revisions to its wastewater treatment facility and incorporated a plate filter press for the dewatering of sludge as it was produced. This had eliminated the need for the three dewatering impoundments and allowed for their closure. The Closure Plan was approved on August 7,1987 and recommended that the lagoons be closed as a hazardous waste landfill with at least 30 years of post-closure ground water monitoring. The lagoons were removed and placed in a closed hazardous waste landfill by the date of the 1990 CME inspection. The landfill was not certified and/or inspected by a RCRA inspector. The Ohio EPA is planning a TSD/ Post-Closure inspection in the near future.

The location of three sludge dewatering impoundments is shown in Figure 2. Each impoundment was 200 feet wide by 500 feet long, and was enclosed entirely by earthen berms. Each impoundment had a useful sludge holding depth of three to four feet (4), with a maximum capacity of 13,000 cubic yards of sludge. The bed of each impoundment was comprised of successive layers of sand and gravel above a network of four inch drain tiles. This underdrain system allowed the water in the sludge to percolate into the drainage network and be conveyed by gravity to the storm sewer.

According to the Ground Water Quality Assessment Plan Phase II (May and June 1987), a partial waste characterization of the surface impoundment sludges was performed in 1982. The impoundments were divided into quadrants. A sample was collected from each quadrant and analyzed for RCRA parameters to determine its status as a hazardous material. The sludges were found to be non-hazardous with respect to pH, flash point, corrosivity, and reactivity. Analyses of various total metals are presented in Table 1. The results show nickel, chromium, copper and zinc in the largest concentrations, with only a small fraction of the total chromium consisting of the hexavalent ion.

According to the Part B-Post Closure Permit application of November 1988, an additional comprehensive sampling and analysis program was implemented to characterize the sludge waste that was removed from the surface impoundments and placed in the hazardous waste landfill, (Figure 3). The waste was found to have the following concentrations of total metals: (Ref. #7)

Concentration (ppm)

Impoundment No.	Cd	Cr	Ni	Cn
1	2-7	13,300	3990	2.2
2	2-5	16,900	6120	2.2
3	2-5	9,720	3150	4.7

In addition, the sludges in the surface impoundments were sampled and analyzed for 35 hazardous substance list volatile organic compounds (VOCs) in June 1987. The results were submitted to the Ohio EPA and are present in Table 2.

Two VOC constituents (Methylene Chloride and Trichloroethene) were detected above detection limits in sludge waste samples, however, these two constituents were not believed by the facility to be representative of waste characteristics because,

1. The Methylene Chloride was detected above detection limits in all the samples and was also detected in the blank samples. Therefore, it was concluded by the facility that this containment was believed to be related to a laboratory analysis error and not the waste.

2. Trichloroethene was detected in one sample at the west half of the third surface impoundment and not in the other five samples. The detectable concentration was very low.

In addition to the above described wastewater treatment for the electroplating wastes, the GMC-Fisher Guide plant also had a treatment unit for neutralizing non-reacted raw materials used in urethane foam molding (toluene diisocyanate). This unit consisted of two 40'x20'x4' open concrete tanks into which open drums of waste raw materials were placed and allowed to fully react. The neutralization of toluene diisocyanate (TDI) was assisted by the addition of water at this site. Fully reacted foam was subsequently disposed off-site in an approved landfill. This treatment process was not being regularly used and was closed per the approved closure plan. However, this closure was not evaluated by Division of Solid and Hazardous Waste Management (DSHWM).

GMC manufacturing operation and plant is closed at this time. The sludge in the surface impoundments was stabilized using cement kiln dust (CKD) and removed to an on-site RCRA Landfill. The landfill, which is located where surface impoundments 1 and 2 used to be, was capped and closed per the approved closure plan. GMC continued to generate significant volumes of hazardous waste because of waste removal activities and equipment cleaning. The waste removal activities consisted of cleaning of the wastewater treatment system, disposal of unused fuels, and disposal of soils and unused water treatment chemicals, which were disposed of to an off-site hazardous waste management disposal, treatment and storage facility. The type of wastes that were generated at the facility during waste removal activities are D001, D007, F002, F003, F006, and U223.

Drummed hazardous wastes generated within the manufacturing plant were stored in 55 gallon drums in the marshalling area at column Y-8 within the plant prior to transfer to an outdoor storage pad located at the east side of the coal car unloading area. Hazardous waste stored at these sites consists of waste paints, adhesives, cleaners, and solvents from production and maintenance operations. This area is no longer used, and the status of its closure certification is not known at the present time. However, the facility has sold most of the property (Parcel A), which contained the drum storage pads, with the exception of the landfill area (Parcel B).

GMC is proposing in it Post-Closure Permit Application an annual sampling of the leachate that will be collected from the landfill leachate collection system. The samples will be tested for the following parameters:

> chromium, copper, nickel, cyanide, pH, total suspended solids, total dissolved solids, specific gravity, chloride and sulfates.

Based on a review of waste characteristics of the Part B-Post Closure Application of November 1988, the following parameters: zinc, hexavalent chromium, methylene chloride, and trichloroethene, should be added to the analysis list.

Regulatory History

The following list summarizes major regulatory activities that took place at the GMC-Fisher Guide Plant from May 1987 to present:

- A Closure Plan was received by Ohio EPA on May 26, 1987.

- A Consent Decree has been signed by both GMC officials and the Ohio Attorney General's Office. The document was signed by a judge on September 23, 1987.

- A CME violation letter was issued on October 23, 1987. The violation was OAC 3745-65-93 (D)(4)(a). Subsequently, a Ground Water Quality Assessment Report (GWQAR) dated December 1987 was implemented and submitted to the Ohio EPA.

- A July 13, 1988 letter from Ohio EPA to GMC, stated that the company can return to detection monitoring and the detection monitoring system is required to comply with the approved closure plan.

- In July 1988, the Director approved GMC Fisher's, Elyria closure extension time to August 31, 1988.

- On August 31, 1988, Ohio EPA received a letter from GMC proposing modification its closure plan to meet the Ohio EPA closure plan conditions. These modifications are:

1. New monitoring well numbering system as in Figure 4.

2. To install four shallow ground water monitoring wells screened in the overburden (Figure 5).

3. Install P-11 (RW-4) in accordance with approved closure plan.

4. Monitor upgradient well MW-7 and downgradient wells P-1, P-2, P-8 and P-11 within the Berea sandstone. In addition, monitor upgradient well M7T(P-7T)and downgradient wells P-2T, P-8T, P-1T within the shallow zone.

5. Establish background concentration for all new wells as per 40 CFR 265.92, Appendix III of 40 CFR 265 and approved closure plan.

6. Perform statistical evaluation per 40 CFR 265.93(b).

- GMC Fisher has completed surface impoundments closure and submitted a Closure Certification report to the Director on October 3, 1988 and a Part B - Post Closure Permit application on November 8, 1988.

- In 1989, GMC Fisher was found to be generating waste that resulted from cleaning up activities. GMC submitted a waste management activities report which included the type of waste, its disposal process and the name of companies participated in receiving the waste.

III. REGIONAL HYDROGEOLOGY

The Elyria area lies on the glaciated, relatively flat, lake plain on the beach ridges of Old Lake Whittlesey, Lake Maumee, and Lake Warren. The area physiographic province is near the boundary of the Appalachian Plateau and Central Lowland province at an elevation ranging from approximately 737 to 750 feet above mean sea level (MSL) (Reference #8 and Figure 1).

This area was abraded by the Wisconsinan ice sheet, leaving a thin layer of drift material. The drift material consists of clay-rich soil and extends 25 feet in thickness (References #8 and 11).

Bedrock in this vicinity consists of the Berea sandstone, which underlies a non-continuous shale that belongs to the Orangeville shale of the Cuyahoga Group, Mississippian Age (Figure 6). The Bedford shale of the Mississippian Age underlies the Berea sandstone.

The most important bedrock aquifer in Lorain County is the Berea Sandstone. The Berea typically yields 3-10 gpm, under long-term withdrawal (References #10 & 11).

IV. SITE HYDROGEOLOGY

Geologic Setting

The GMC-Fisher Guide facility is situated near the boundary of the Interior Lowlands Physiographic Province, at an approximate elevation of 750 above mean sea level (MSL), an area of relatively flat lying sedimentary rock Devonian and Mississippian age. In the area of the facility, a thin veneer of glacial till, deposited during the Pleistocene overlies the site to thicknesses of 14 feet to an elevation of 736 feet MSL. Bedrock underlies this till deposit at relatively shallow depths. A geologic column identifying the units that would be encountered in Lorain County is shown as Figure 6.

Hydrogeology

The Ground Water Quality Assessment Report (GWQAR), Phase II of December 1987, and References 4 & 7, divided the geology in the vicinity of the GMC-Fisher Guide facility into four stratigraphic units based on boring logs of existing on-site monitor wells, Figures #4, 5, and 7. Geologic cross-sections developed from well logs are present in Figures 8 and 9. The description of the stratigraphy is as follows:

The uppermost unit consists of soft, light brown to greenish gray silty clay till deposited during the Wisconsinan glacial advance approximately 10,000 years ago. This unit generally ranges in thickness from 6 to 14 feet below the site (at an elevation ranging from 742 feet to 736 feet above mean sea level (MSL). Underlying the till deposits is the Orangeville Shale consisting of soft, light greenish gray shale. This unit is absent under most of the site, however, it has been identified in borings from the southeast portion of the site. Its maximum thickness under the southeast portion of the site is approximately 5 feet. The Berea sandstone underlies the glacial drift or Orangeville Shale (depending on whether or not the shale unit is present) and is considered the uppermost aquifer. The Berea sandstone is generally described as a hard, fine grained sandstone with occasional very thin shale interbeds. The existing water table is located within this unit and the overlying glacial till. In the area of the former surface impoundments, the sandstone is a wedge-shaped aquifer which thickens to the northwest from approximately 5 to 23 feet. Underlying the Berea Sandstone, which extends to an elevation ranging from 735 to 725 feet above mean sea level (MSL) is the Bedford shale. It is generally described as a gray to reddish silty shale with some thin sandy horizons (References # 7&8).

On-site borings have not penetrated the entire thickness of the Bedford Shale, however, background information indicates that the unit averages from 50 to 90 feet in thickness. On-site borings which penetrate the Bedford Shale indicate that no mappable sandy horizons exist within the shale for at least 10 feet below the Berea sandstone.

Ground water level elevations at the GMC-Fisher Body Plant had been variable historically and might have been dependent on the sludge and water content of the lagoons prior to closure. In February 1985, a water table map was constructed utilizing the existing wells P-1, P-2, P-3, P-4, P-5 and P-6 (Figure 10). Since it appeared that upgradient well P-6 might be influenced by ground water mounding, well OW-1 was installed subsequently to more accurately characterize ground water flow and background conditions, monitoring well OW-1 is being terminated by the facility, because of a future City Road that is engineered to include the area of the well.

Static water measurements taken in September 1986 did not exhibit a mounding affect but defined a more regional flow direction to the northeast. However, water level measurements taken two months later in November 1986 again reflected a ground water mounding configuration around the lagoons. Refer to Figures 11 and 12 for the 1986 maps of the potentiometric surface in the vicinity of the lagoons. Water level measurements taken during the CME inspection on September 4, 1987 (Figure 13) still reflect a ground water mounding configuration in the vicinity of the lagoons although it is less pronounced than in 1986.

According to References #6 and 7, water table level elevations obtained during September 18, 1987, sampling event (Figure 14) showed a slight ground water divide, with the axis of the divide trending east-west, transecting the center of the surface impoundments (prior to closure). Therefore, ground water flow was noted to be in a northeast and a southeast direction under the former surface impoundments. This flow is believed to be controlled by both mounding and structural effects. The structural effects are illustrated in Figure 15, top of Berea sandstone bedrock map. The map shows a small north-south trending bedrock ridge to exist directly below the (former surface impoundment) present landfill.

In August 1988, ground water elevations were obtained and are presented in Figure 16. The map demonstrates that the on-site hazardous waste landfill has changed ground water flow direction to the east-southeast as interpreted by Ohio EPA. Ohio EPA's conclusion does not agree with GMC Fisher in their November 1988 Part B-Closure Application, that ground water flow is to the east-northeast. To determine the consistency of the east-southeast direction of ground water, additional measurements and potentiometric surface maps are needed for all the wells.

An evaluation of newly submitted ground water elevations (Table 3) for monitoring well clusters of May, August, November 1989 and February 1990, indicate that the difference between the shallow and the deep monitoring well elevations (Table 3a) can be related to an artesian aquifer condition of the Berea sandstone, which appears to be influenced greatly by the landfill.

TABLE 3

	Ground Water Elevations				Top of Casing Elevation
Well No.	5-31-89*	8-30-89*	11-21-89*	2-21-90**	
P-1	743.10	---	741.94	743.01	752.20
P-1T	742.10	Dry	741.14	742.38	751.42
P-2	747.43	---	746.45	747.82	751.43
P-2T	744.76	742.49	743.69	744.76	749.42
P-5	746.50	---	745.61	746.37	754.97
P-5S	744.85	744.61	745.80	746.61	754.21
P-7	752.60	748.51	749.56	752.44	755.54
P-7T	750.17	745.37	746.71	749.98	753.48
P-8	747.56	745.91	747.24	747.93	753.53
P-8T	745.45	743.18	744.46	745.32	750.92
P-11	740.69	740.69	741.15	742.77	749.47

All elevations in feet above Mean Seal Level (MSL)

--- Not measured

* Source: A letter, which was submitted to the Ohio EPA on February 8, 1990.

** Source: 1990 CME Inspection.

Table 3a

Ground Water Elevation Difference (ft.)

Well No.	5/31/89	8/30/89	11/21/89
P-1 P-1T	1.0	______	0.78
P-2 P-2T	2.67	______	2.01
P-5 P-5S	2.65	______	0.19
P-7 P-7T	2.11	2.73	2.78
P-8 P-8T	2.11	2.73	2.78

- Note: All calculations were conducted by subtracting shallow well elevation from deep well elevations.

An Ohio EPA potentiometric surface maps (Figure 16A, 16B and 16C), indicate that ground water is moving in a northeastern direction. These maps should include all the wells that exist on site and should be in elevations above mean seal level and not depths in feet to water from the top of casing.

Horizontal flow gradients range from (0.002 to 0.004 ft/ft) upgradient of the former surface impoundments and approximately 0.02 ft/ft downgradient of the former surface impoundments. The vertical gradient is little to none based on water level data evaluation of P-5 and P-5S of 1987 data. Subsequently, 1989 data demonstrate that a vertical gradient is present (table 3 and 3a).

The hydraulic conductivity was obtained for twelve wells in the Berea sandstone utilizing bail down-recovery test. Hydraulic conductivity test results, which are summarized in Table 4, were found to range from 6×10^{-3} ft/day to 2.5×10^{-1} ft/day, except in the vicinity of monitoring wells P-5 and P-5S. P-5 and P-5S conductivities ranged from 1 ft/day to 3.5 ft/day (reference #6).

The ground water flow velocity was calculated (References #6,7) to be 2.7×10^{-2} ft/day utilizing the following equation and variable values:

Flow velocity = $\frac{Ki}{n}$ where,

K = Hydraulic Conductivity; an estimated average value of 4×10^{-1} ft/day was used in the calculations. This value did not include values obtained from monitoring wells P-5 and P-5S.

i = Hydraulic gradient; a value of 0.01 was utilized in the calculation.

n = Porosity; an assumed value of 15% for the sandstone (Freeze and Cherry 1979) was utilized in the calculation.

However, the ground water velocity was calculated by the Ohio EPA utilizing 4×10^{-1} ft/day (average hydraulic conductivity, 15% (an estimated average sandstone porosity), and horizontal gradient 0.02 ft/ft downgradient of the landfill (value obtained by the Ohio EPA), to be 5.33×10^{-2} ft/day.

It must be noted that ground water flow velocity value could be much higher within the vicinity of monitoring wells P-5 and P-5S, due to higher hydraulic conductivity values. It must be noted, also, that the sandstone porosity range from 5 to 30% (Freeze and Cherry 1979), therefore, to be able to calculate and estimate ground water flow velocity, the porosity must be determined.

V. GROUND WATER MONITORING SYSTEM

Monitoring Well Locations

Seven monitoring wells have been installed near the former sludge impoundments. Between May 13 and May 19, 1981, four borings were advanced around the active sludge disposal area at the Fisher Body Division, General Motors Corporation in Elyria as part of a geotechnical investigation undertaken to meet the requirements of 40 CFR, Part 265, Subpart F. Each of the four borings was constructed into a monitor well and labeled P-1, P-2, P-3 and P-4.

After review of the initial findings of the geotechnical investigation, two additional wells (P-5 and P-6) were installed around the sludge lagoons during the week of July 26, 1981. Well OW-1 was installed in December 1985 to more accurately characterize background ground water quality in the area of the sludge impoundments. Well P-4 was destroyed by vehicular traffic and has since been adequately sealed. Refer to Figure 4 for the location of the existing wells.

The revised monitoring well strategy set forth in the May and June 1987 Assessment Plan proposed to replace Well P-4 and install four additional monitor wells (monitor wells P-5S, P-7, P-8, and P-9). These wells were installed during the week of August 31 to September 4, 1987. Additionally, monitor well P-10 was installed at the southern boundary of the lagoons as a result of the EM-34 survey that was conducted in June 1987. The locations for these wells are illustrated in Figure 4. Cross-sections relating the new wells to the site stratigraphy are depicted in Figures 8 and 9.

According to the June 1987 Ground Water Assessment Phase II, monitoring well P-4R will replace its closer, non functioning counterpart. The location of well P-4R is slightly north of its original location to provide better hydrologic control for defining the ground water mound. Monitor well P-7 is located approximately 400 feet west of the southwestern corner of the southern most impoundment. Based on present hydrogeological interpretations of the ground water mound size and geometry, the location of this well will enhance upgradient control for both water quality and potentiometric surface elevation more than monitoring well P-6. It will supply additional stratigraphic control for the Berea Sandstone and provide better definition of the upgradient extent of the ground water mound. If it is determined after installation that monitor well P-7 may still be impacted by the ground water mound, the assessment plan stated that an additional ground water monitoring point may need to be installed further upgradient of this location.

Based on an evaluation of September 18, 1987, and August 1988 ground water elevation maps (Figures 14 and 16 and 16A), it appears that monitoring well P-7 is not influenced by mounding of the previous surface impoundments or the present landfill. However, additional ground water level readings and maps are needed to be able to conclude monitoring well P-7 is not impacted by the present landfill.

Monitor wells P-8 and P-5S will be used in conjunction with existing well P-5 to determine if the volatile organic contamination in this area is related to the surface impoundments. Monitor well P-8 is located north (downgradient) of the impoundments but south (upgradient) of the former dye storage pad used to isolate potential volatile constituents emanating from the impoundments. This well is screened in the upper part of the Berea Sandstone. Monitor well P-5S is clustered next to the existing deeper well P-5. The new well is screened in the upper portion of the Berea Sandstone to provide an effective monitoring point for downgradient migration of both light and heavy constituents to determine vertical gradients within this portion of the aquifer.

Monitor well P-9 is located at the furthest downgradient point possible without being potentially impacted by the past disposal areas. The exact placement of this well was refined according to the results of the geophysical survey performed during the week of June 15, 1987. The well is screened at the base of the Berea Sandstone which is approximately 12.5 feet thick based on the well information.

Two shallow soil borings (SB-1 and SB-2) were performed south of the existing monitor wells P-2 and south and east of the existing monitoring well P-3. The primary purpose of these borings was to determine the nature of the overlying glacial till materials in these areas. The June 1987 Assessment Plan stated that particular attention will be given to defining whether water table conditions exist within the glacial till. The borings were to extend only into the top of the underlying Orangeville Shale. The assessment plan also stated that if it is determined that water table conditions exist within the glacial overburden, and if hazardous waste or hazardous constituents have been released to ground water as determined by the proposed study, then additional ground water monitoring points may need to be installed at these points and screened in the glacial overburden. However, based on an evaluation of soil boring logs SB-1 and SB-2, shows that water table was encountered at 14.0' in the sandstone at SB-1 and no record on the log of water at SB-2. In addition, a note on SB-2 log stated that a black wet layer had no hydrocarbon smell and no detection on Organic vapor analyzer (HNU).

In October 1988, GMC Fisher had installed five additional monitoring wells (P-1T, P-2T, P-7T, P-8T and P-11) (Figure 5). Monitoring wells P-1T, P-2T, P-7T, and P-8T were placed adjacent to monitoring P-1, P-2, P-7 and P-8 and screened to monitor the shallow till zone (Reference #9). Monitoring well P-11 was installed between monitoring wells P-1 and P-2, east of the former surface impoundments (presently landfill). When evaluating monitoring well logs, it was noted that all the October 1988 shallow wells were screened in the till/bedrock with the exception of monitoring well P-1T and P-11. P-1T was screened in the till and P-11 was screened primarily in the sandstone except for 0.5 feet in the till.

Three samples were taken from P-7T, P-8T and P-1 at depths that corresponds with the bottom of the landfill to define the total amount of cation exchange capacity (CEC) of the soils. Results of this test that was conducted in accordance with procedures specified in ASTM special technical publication No. 479 (known as the Ammonium Saturation Method), were found to be ranging from 10.3 meq/100g to 13.1 meq/100g (Table 5). These values were found to be within the range of Kaolinitic type clay materials (3-15 meq/100g (Carroll 1959; Grimm 1980)).

TABLE 5

SUMMARY OF CATION EXCHANGE CAPACITY DATA*

Boring Location	P-1T	P-7T	P-8T
Depth Interval	8.5'-10'	13.5'-15'	6'-7.5'
Cation Exchange Capacity (meq/100g)	11.5	10.3	13.1
Exchangeable			
Ca(meq/100g)	185	174	221
Mg(meq/100g)	25	16.10	21.9
K (meq/100g)	4.55	7.52	5.43
Na (meq/100g)	2.16	2.46	3.63

*Source: Reference #7

During the CME inspection wells were found located as the map illustrated in Figures 4 and 5, except for monitoring wells P-7 and P-7T were located west of a fence line that extends from monitoring OW-1 to the plant (Parcel A) fence.

Monitor Well Construction

Seven monitoring wells (P-1, P-2, P-3, P-4, P-5, P-6, and OW-1) are constructed of 2.0 inch inner diameter (I.D.) PVC with glued joints except for P-4; which was damaged and properly sealed. All screens are five feet long. A gravel pack extends from the base of the well screen to approximately one foot above the top of the screen. One foot of sand was placed above the gravel pack and the remainder of the annular space backfilled with a bentonite slurry. Protective steel casings were placed over the PVC risers at the surface.

Six additional monitoring wells, P-7, P-8, P-9, P-10, P-5S, and P-4R) were installed as part of the ground water assessment that was conducted during 1987. These wells were drilled using hollow stem auger method as was done for P-1 through P-6 and OW-1. Soil samples were obtained continuously using split spoon samples except for P-7, it was sampled at 2.5 feet intervals to the 17.5 depth. Monitoring well P-7 was constructed of 2.0 inch I.D., PVC casing with 5.0 feet of 0.010 slotted PVC screen monitoring wells P-8, P-9, P-10, P-5S and P-4R were constructed utilizing 2.0 inch I.D. stainless steel casing with a 5.0 foot of 0.010 slotted stainless steel screen. The well screen bottoms were placed at depths ranging from 15 to 21 feet below the ground surface. All equipment used for drilling and well construction was decontaminated prior to using a portable steam cleaner. The screens were packed with silt free flint sand (WB 40 grade) as per Ground Water Quality Assessment Plan of June 1987, to a height of more than two feet above the top of the screen. A two foot thick seal of compressed sodium bentonite pellets was placed above the sand pack. The rest of the annular space in all the wells was filled with a cement-sodium-bentonite grout, which was placed with a tremie pipe. A four inch diameter galvanized steel, locking protective casing was installed at each well. A concrete anchor surrounding the casing was installed at the surface.

During October 1988, five additional wells, (P-7T, P-1T, P-2T, P-8T and P-11 were installed in shallow till bedrock as part of the detection/post-closure monitoring system that will be implemented on site for thirty years. These wells were installed and constructed as described in the above paragraph. However, these wells used PVC casing and screens. The screen bottom depths for P-1T, P-2T, P-7T, and P-8T are 10.0, 13.5, 12.5 and 10.0 feet below the ground surface, respectively. All monitoring wells installed at the site, were developed by surging and pumping. All the wells were inspected on February 21, 1990. The Environmental Engineer, (Philip R. Kienle) was not present but able to provide access to the site to inspect the wells and their sampling analysis and procedures, which was performed by OHM,Inc. The wells stability was noted as satisfactory with the exception of monitoring well P-1. Most wells were not protected by well guards. The majority of these wells need maintenance and surface concrete repairs. The following wells were noted to be in need of immediate surface repairs: P-1, P-1T, P-2, P-5S, P-7, P-7T, P-9, P-10 and P-11. Monitoring wells P-8 and P-8T protective casings were covered with soil so the concrete caps integrity could not be evaluated. It was also noted that monitoring well P-6 protective casing lid was broken and the inside PVC casing did not contain a cap.

Two monitoring wells were found at the site and not on the map. The first well had a protective casing and was located north of the concrete pad, which is north of the landfill and adjacent railroad track. This well must be identified by the facility. The second well was located southwest of the landfill and north of P-6. This well was found to have no cap on the PVC riser pipe and no protective casing.

It should be noted that monitoring well P-11 was shown at two different locations on map Figures 4, 5, 7, and 13 (References # 6,7). However, according to Map Figure 17, the most recent map, and Philip R. Kienle, of GMC Fisher monitoring well P-11 is located east of the site between P-1 and P-2 as mentioned in the monitoring well location section of this report.

VI. DETECTION, ASSESSMENT AND POST CLOSURE DETECTION MONITORING

First year, quarterly RCRA monitoring for background groundwater quality was conducted in 1982 and was followed by semi-annual sampling beginning in May 1983. Data comparison at the end of each semi-annual sampling episode in 1983 and 1984 indicated statistically significant differences against the 1981 background and upgradient data for TOX, pH, specific conductance and TOC.

General Motors Corporation contracted Ground Water Technology, Inc., to develop a Ground Water Quality Assessment Plan (GWQAP) which was subsequently submitted to Ohio EPA in August 1984. Field work on the assessment was initiated in October 1984 and the investigative findings were discussed in a February 1985 report by Ground Water Technology. This report indicated that various non-hazardous parameters such as chloride and sulfate appeared to be entering the ground water. In addition, elevated levels of volatile organic compounds were found in well P-5. These compounds were primarily trans 1, 2- dichloroethene and trichloroethene.

In October 1986, the Ground Water Quality Assessment Program - Proposed Plan for Phase II was submitted to Ohio EPA by the Chester Engineers. The main objectives of the Phase II assessment program were to more accurately define the horizontal and vertical configuration of the non-hazardous constituent plumes and to determine the source of the volatile organic compounds in well P-5. Concentrations of chloride and sulfate in monitor wells during a June 1986 sampling were represented by isopach maps in the 1986 report. These maps were included in the previous 1987 CME report as Figures 18 and 19. This CME, includes concentrations of chloride and sulfate from monitor wells during September 1988 sampling event presented by isopach maps as in Figures 20 and 21. The chloride isopach map (Figures 18 and 20), are somewhat similar in concentration values. The center of the Isopach in Figure 20 is narrower and is located north of the former surface impoundments. Sulfate isopach maps, (Figures 19 and 21), show two zones of increased concentration northeast and southeast of the surface impoundments. It should be noted that Sulfates and Chloride concentrations are less then previously obtained values.

The assessment plan submitted by Chester Engineers in October 1986 was not implemented by General Motors Corporation. Another "Ground Water Quality Assessment Plan-Phase II (GWQAP)" was completed by Weston Inc., and submitted to Ohio EPA in December 1986. This document was revised in March and May 1987. Ohio EPA has reviewed the May 1987 Ground Water Quality Assessment Plan, Phase II and noted some deficiencies in the plan. Ohio EPA received a revised GWQAP approved in June 1987, subsequently General Motors Corporation implemented the plan.

An electromagnetic terrain conductivity survey was conducted by Weston, Inc., during the week of June 15, 1987. This study was used to further refine the siting of additional monitor wells. Subsequently, six additional monitor wells were installed around the lagoons during the week of August 31 - September 4, 1987.

The GWQAP was finalized in a report in December 1987 and submitted to the Ohio EPA in February 1988.

In November 1988, the facility had submitted a Part B-Post Closure application. This application discusses the new on-site hazardous waste landfill and specifically, the post closure ground water monitoring system.

According to the Post Closure Application (Reference #7), The post-closure detection ground water monitoring system consists of four shallow till/bedrock wells (P-1T, P-2T, P-8T and P-7T) and five bedrock wells (P-1, P-2, P-8, P-11 and P-7). In addition to these wells, GMC is presently sampling P-5 and P-5S wells. These wells are presented on Figure 17. According to the post closure application, ground water upgradient wells consist of the P-7 and P-7T cluster, and downgradient monitoring wells consist of: P-1, P-1T, P-2T, P-8, P-8T, P-5, P-5S and P-11 monitoring wells clusters. P-11 is a single well.

GMC Fisher, Elyria, has started establishing the first year, quarterly, background data and is in the process of beginning the second year monitoring, as per Reference #7 and Philip Kienle of GMC Fisher, Elyria. The facility has proposed to test for the following ground water indicators and water quality parameters during the post-closure monitoring (present detection system):

Chromium (+3)	Lead	Chromium (+6)	Magnesium
Copper	Sulfate	Iron	Manganese
Nickel	pH	Zinc	Specific Conductance
Chloride	T.O.C.	Phenols	T.O.X.
Sodium			

These parameters are going to be tested semi-annual during the thirty years of monitoring at the site. In addition to sampling and testing, the facility is proposing to perform statistical and annual determinations. The statistical determination is conducted utilizing Cochran's Approximation Method and Average replicate method in the case of a false positive. Both methods will utilize 4 replicates (portions of the same sample) and 0.05 level of significance for Cochran's Approximation Method. A confirmation sample will be obtained by the facility if the analysis and calculation confirmed that it is statistically significant.

The annual determination will consist of:

- preparation of a water table contour map
- determining and confirming ground water flow direction.
- Calculation of ground water flow rate.

The review of the ground water monitoring system as proposed in the Post-Closure application during this CME was evaluated in accordance with Ohio Administrative Code (OAC) 3745-65-90 through 3745-65-94 (40 Code of Federal Regulation (CFR) 265 Sub Part F).

In accordance with the above stated rules, the proposed ground water detection monitoring system for the landfill (previously surface impoundments) lacks the following:

- Ground water parameters, which characterize the stability of ground water as a drinking water supply under OAC 3745-65-92 (B)(1), 40 CFR 265.92 (b)(1) for new wells, are not presented in the list of parameters proposed by the facility in reference #7 Table E-11, (the above reported parameters, which is part of this section). However, upon an evaluation of the sampling data that was submitted to the Ohio EPA on February 8, 1990, the shallow upgradient and newer wells appear to have the parameters in OAC 3745-65-92 (B)(1) tested for. For additional information, see the next section: Sampling frequency and Data Evaluation.

- A Ground Water Assessment Plan outline, which shall be prepared in accordance with OAC 3745-65-93 (A).

The facility stated in their report that an appropriate notification of a statistically significance in the ground water will be made and submitted to the Ohio EPA, if the confirmation sample (second round sample), demonstrates a statistical significant difference in the ground water. However, the facility did not include an outline of a ground water quality assessment program if the facility has shown statistical difference. Even though the facility had completed an assessment in December 1987 on the former surface impoundments, it must provide a ground water quality assessment outline per the requirement of OAC 3745-65-93.

It was stated in the Post-Closure Application, November 1988, that monitoring wells P-5 and P-5S will be replaced with monitoring wells P-8 and P-8T. Ohio EPA approves of eliminating monitoring wells P-5 and P-5S from the Post-Closure landfill detection monitoring system and using P-8 and P-8T as replacements. However, the facility should utilize monitoring wells P-5 and P-5S for the sampling of VOC's at times that coincide with the frequency stated in the Post-Closure monitoring system and determine the source, horizontal and vertical extent, rate of flow and the concentration of these contaminants.

V11. GROUND WATER SAMPLING

Sampling Analysis Plan (SAP)

Sampling procedures at the facility were observed on February 21, 1990. The facility's sampling was conducted by OHM,Inc. This section will evaluate the sampling analysis plan, and the field adequacy of the contractor's sampling technique and procedures.

The Sampling Analysis Plan that is utilized at the facility and included in the post closure permit application (Reference # 7), was reviewed by the Ohio EPA during the writing of the CME. Results of the review are listed below:

- The proposed wetted tape method for measuring ground water level is not recommended. A mechanical sounding device is acceptable and the electric water level is highly recommended.
- The facility should use a sampling line that is made of inert material, such as a teflon coated tape. The plan should also indicate the rate of flow for the pump(s) used in the process.
- It is recommended to collect the sample using a bottom emptying bailer instead of a top emptying bailer to minimize sample agitation.
- The SAP does not contain a decontamination procedure that should be followed by the consultant during sampling events.
- The facility must indicate the type of filtration equipment and method that will be used.
- Table E-13 of Reference #7 is not accurate. We recommend that newer editions of SW-846 be used as well as the Technical Enforcement Guidance Document (TEGD) for guide line and accurate information for test methods and reference.
- An evaluation of table E-14 (Analytical Methods), of the Post Closure Application of November 1988, noted that sodium and sulfate referenced method EPA 273.1 and EPA 325.2 that are different than referenced in the SAP (EPA 200.7 and EPA 357.1).
- There is no method reference given for Total Organic Halogens in Table E-14 of Reference #7.

The following observations were noted by the inspector during the contractor's sampling of the company's monitoring wells:

- Plastic ground cover around the wells was not used to minimize contaminated water from spilling on the soil and to keep equipment clean.

- The measuring tape was not decontaminated properly to prevent cross contamination of wells. The measuring tape was decontaminated with distilled water only and up to a length of approximately five (5.o) feet, even though the tape was used to measure the total depth of the wells. The contractor was informed of the improper technique.

- All sampling jars were labeled with a field number and did not have an adequate sampling label. The field log book contained the well number of the sample and the date. However, the field log book did not have the time it was collected. For additional information see appendix A.

- All the samples, which were collected while I was on site, were preserved when the samples were taken back to the truck.

- Samples collected for dissolved metals analysis were filtered only after sampling of several wells was completed.

Sampling Frequency and Data Evaluation

Since GMC Fisher was in a ground water quality assessment program in 1987, and returned to a ground water detection monitoring program in July 1988, GMC's sampling frequency and events of the system (old, new and proposed monitoring wells) will be evaluated as follows:

1. A ground water assessment monitoring system installed in September 1987 was sampled quarterly for two quarters. GMC Fisher submitted the results of the GWQA in a report to Ohio EPA in February 1988 indicating that no hazardous waste or hazardous waste constituents were released from the surface impoundments. GMC Fisher was notified by Ohio EPA to return to a detection monitoring system that will comply with the approved closure plan and the OAC 3745-65-90 through 3745-65-94.

2. The facility returned to semi-annual sampling for the inplace ground water detection system. This could only be implemented on the existing monitoring wells that were installed during the assessment phase (P-1, P-2, P-3, P-4R, P-5, P-5S, P-6, P-8, P-9, P-10).

3. As required by the closure plan, the facility added 5 new wells that included new upgradient monitoring wells. These wells and the new proposed detection monitoring system should establish background ground water quality for monitoring wells P-7 and P-7T P-8, P-8T, P-11, P-1T and P-2T for all parameters specified in OAC 3745-65-92(B), and to use P-7 and P-7T as a referenced upgradient monitoring wells in the statistical analysis. However, it must be noted that monitoring well P-7 should have been on quarterly monitoring, during 1987 and 1988 to establish background concentrations for P-7 (upgradient monitoring well). P-7S should have been used for 1988, and future statistical determinations. Monitoring wells P-1T P-2T, P-7T and P-8T background concentrations will have to be starting in November 1988, because they were installed after the closure and an Ohio EPA agreement with the facility.

4. The facility will maintain a semi-annual sampling frequency that is in compliance with OAC 3745-65-92 (D) and in addition, sample for specific constituents that are characteristics of the waste placed in the landfill.

The facility has returned to a detection monitoring system in July 1988. The facility has conducted two quarters of sampling (March and June 1988), which meets with item #1 and complies with detection monitoring rules (OAC 3745-65-90 through 3745-65-94) to establish background water quality in the newly installed wells.

These two sampling events were evaluated and MCL's exceedence results are presented in Table 6. In addition, neither sampling event had included tests for radium, Gross and Gross B for monitoring wells P-9, P-10, P-4R and specifically P-7 (future upgradient monitoring well) as required by OAC rule 3745-65-92(B). Chromium was sampled for at monitoring well P-3 during June 1988 sampling event. Total coliform and turbidity tests conducted are also presented in Table 6 and exceedence of MCL's in all the wells. Statistical analysis was performed for both sampling events and presented in Table 7.

Based upon the ground water monitoring data submitted , GMC Fisher continued sampling monitoring wells P-1, P-2, P-3, P-5, P-5S, P-6, P-7, and P-8 quarterly until December 1988.

During March, June, August and December 1988, GMC Fisher should have completed sampling monitor well P-7 and established background concentrations to be utilized for the future sampling data comparison and statistical analysis determination. GMC did not sample for Radium, Gross and Gross B, which are constituents required per OAC 3745-92-B (1) (40 CFR 265.92 (b)(1) (Appendix III)). However, these parameters were reported for P-7 in 1989 sampling events.

In an evaluation of August and December 1988 Ground Water Data, it was noted that Iron and manganese in all the wells were detected above the MCL limits. (Note Table #6)

In addition, nickel was reported at 540 ug/l in P-3 (August 1988) as compared to reported nickel concentration in P-7 of 10 ug/l and 430 ug/l in P-3 (December 1988) as compared to P-7 of 34 ug/l.

The facility reinstated its detection monitoring system in February 1989, which is considered the first semi-annual sampling event for the existing monitoring wells and quarterly for the five (5) new additional wells (P-1T, P-2T, P-7T, P-8T and P-11). Therefore, the following three items in addition to items 2 and 3 of Sampling Frequency and Data Evaluation Section, will be taken into consideration when evaluating the rest of the data:

a. The existing monitoring system will be sampled semi-annually starting with February 1989 sampling event. The wells which will be included in the semi-annual are: P-1, P-2, P-5, P-5S, P-7, P-8 and P-11 (even though it is new, it should be included because it is primarily a deep well). These wells' ground water data will be evaluated with respect to OAC 3745-65-92(b)(2) & (3) and constituents that characterizes the waste, which were discussed in an earlier section of this report.

b. The new wells must be sampled quarterly starting February 1989 and analyzed in accordance with the ground water parameters listed in OAC 3745-65-92.

c. All data obtained in 1989 for deeper well should utilize P-7 background concentrations in the determining the statistical analysis and the shallow (till/bedrock) wells will be evaluated once the first year of quarterly sampling is completed utilizing P-7T background concentrations.

The results of the evaluation are:

- Data listed in Table 6 note those ground water parameters in exceedence of MCL's.

- pH and specific conductance data were not submitted for all the wells in sampling events conducted during May and August 1989.

- A level of barium (0.88 mg/l) was found in P-2T, which is higher than P-7T and lower than MCL (1.0 mg/L).

- Testing for radium was not performed during May and December 1989 for the shallow (new) wells.

- Gross alpha and Gross Beta were not included in the report for December 1989.

- Turbidity was not performed for all five new wells in May, August and December 1989.

- Monitoring well P-1T was not included in August 1989 round of sampling.

- Statistical determination was performed should have utilized monitoring well P-7 instead of P-6.

- Total and fecal coliform values are exceeding MCL, which may be due to a nearby sewage line (as per Weston's ground water data report dated August 3, 1989 for may 1989 sampling event.

- Statistical analysis determination for February and December 1989 (Table 7) were not submitted to the agency by the date of the CME Report preparation. However, GMC submitted an annual ground water report that will be evaluated thoroughly at a later date.

In addition, the following constituents were sampled and analyzed for during the 1988 ground water monitoring program: Dichloromethane, Trans 1,2-Dichloroethene, Vinyl Chloride, Trichloroethylene and Trans 1,2-Dichloroethane. Analytical results of the ground water samples are presented in Table 6.

In review of the statistical analysis in Table 7, it was not noted that P-8 has never shown any statistical difference in TOX, except for the May 1989 sampling event. The statistical data indicate significant increase in TOC and specific conductance during the previous two years. However, GMC has sampled and analyzed for site specific metal constituents during this period. The results of samples collected do not indicate that contamination of metals is present at the present time.

TABLE 6
DATA SUMMARY OF PARAMETERS
EXCEEDING MCL IN WELLS FROM 1988 AND 1989

PARAMETERS (MCL)

SULFATES (250 mg/l)	**WELLS/CONCENTRATION (IN ORDER)**
- G.W.Q.A.R. December 1987	P-1, P-3, P-5, P-10 321, 493, 310, 572
- March 1988	P-1, P-3, P-5 300, 460, 330
- June 1988	P-1, P-2, P-3, P-5, P-7 450, 300, 5500, 350, 260
- August 1988	P-3, 380
- December 1988	P-1, P-3, P-5, P-6, P-7 528, 440, 264, 440, 330
- February 1989	P-1, P-2T, P-7T, P-8T 260, 280, 280, 440, 330
- May 1989	P-1, P-2T, P-5, P-7T, P-8T 296, 374, 330, 327, 688
- August 1989	P-2T, P-7T, P-8T 320, 309, 250
- December 1989	P-1, P-2T, P-5, P-7T, P-8, P-8T 318, 330, 318, 289, 318, 1200

IRON (0.3 mg/l)	
-G.W.Q.A.R. December 1987	P-1, P-5S, P-5 0.39, 1.72, 2.5
- March 1988	P-1, P-3, P-5, P-5S, P-6, P-7, P-8 1.0, 0.76, 0.47, 11, 0.53, 0.21, 0.79
- June 1988	P-1, P-2, P-3, P-5, P-5S, P-6, P-7, P-8 0.64, 0.43, 1.9, 0.58, 18, 10.48, 2.6, 0.51
- August 1988	P-1, P-2, P-3, P-5, P-5S, P-6, P-7, P-8 1.8, 1.8, 6.4, 0.58, 21, 11, 0.085, 6.3

TABLE 6 (continued)
DATA SUMMARY OF PARAMETERS
EXCEEDING MCL IN WELLS FROM 1988 AND 1989

PARAMETERS (MCL)	WELLS/CONCENTRATION (IN ORDER)
IRON (continued)	
- December 1988	P-1, P-2, P-3, P-5, P-5S, P-6, P-7, P-8 0.66, .38, 1.3, 1.0, 0.68, 1.1 6.2, 0.87
- February 1989	P-1, P-1T, P-2, P-2T, P-5, P-5S, P-7, P-7T, P-8, P-8T, P-11 0.44, 32, 1.5, 310, 23, 1.4, 22, 62, 1.3, 49, 22
- May 1989	P-1, P-5S 0.41, 5.1
- August 1989	P-5S, 4.3
- December 1989	P-1, P-5, P-5S 0.55, 0.3, 3.4
MANGANESE (0.05 mg/l)	
- March 1988	(0.15 0 7.8) all the wells except P-7 (0.02)
- June 1988	(0.066 - 11) all the wells except P-6 (0.036)
- August 1988	(0.15 - 11) all the wells
- December 1988	(0.1 - 6.4) all the wells
- February 1989	(0.26 - 9.6 all the wells
- May 1989	(0.16 - 9.6) all the wells
- August 1989	(0.21 - 9.0) all the wells
- December 1989	(0.05 - 7.4) all the wells

High values were found in P-5S in all events.

TABLE 6 (continued)
DATA SUMMARY OF PARAMETERS
EXCEEDING MCL IN WELLS FROM 1988 AND 1989

PARAMETERS (MCL)	WELLS/CONCENTRATION (IN ORDER)
TOTAL COLIFORM (1/100 ML)	
- March 1988	P-1, P-3, P-5, P-5S, P-6, P-7, P-8, 12, 85, 28, 2000, 12, 115, 3500
- December 1988	P-2, P-3, P-5 82, 700, 12
- May 1989	P-1T, P-2T, P-5S, P-7, P-7T, P-8, P-8T, P-11 49, 2, 240, 2, 2, 350, 5, 2
- August 1989	P-2T, P-5S, P-7, P-7T, P-8, P-8T, P-11 2, 4, 7, 17, 33, 33, 2
- December 1989	P-1, P-1T, P-2, P-2T, P-5, P-5S, P-7, P-7T,P-8,P-8T,P-11 5, 5, 12, 2, 2, 2, 2, 2, 13, 194, 2
FECAL COLIFORM (1/100 ML)	
- May 1989	P-1T, P-2T, P-5S, P-7, P-7T, P-8, P-11 33, 2, 240, 2, 2, 350, 2, 8
- August 1989	P-2T, P-5S, P-7, P-7T, P-8, P-8T, P-11 2, 2, 2, 2, 33, 33, 2
- December 1989	P-1, P-1T, P-2, P-2T, P-5, P-5S, P-7, P-7T,P-8,P-8T,P-11 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
SELENIUM (0.01 mg/1))	
March 1988	P-1, P-5 0.071, 0.067
LEAD (0.05 mg/1)	
February 1989	P-2, 0.073

TABLE 6 (continued)
DATA SUMMARY OF PARAMETERS
EXCEEDING MCL IN WELLS FROM 1988 AND 1989

PARAMETERS (MCL)	WELLS/CONCENTRATION (IN ORDER)
GROSS (15 Pci/l)	
August 1989	P-8T, 19
August 1989	P-8T, 17
GROSS B (15 PCi/l)	
May 1989	P-8T, 45
CHROMIUM TOTAL (0.05 mg/l)	
December 1987	P-4R, 0.084
February 1989	P-2T, P-7T, P-8T 0.37, 0.055, 0.13
***Dichloromethane** (ug/l) (no MCL value)	
June 1988	P-1, P-2, P-3, P-5, P-5S, P-6, P-7 0.4, 3.0, 7.0, 1.0, 4.0, 5.0, 2.0
August 1988	P-2, P-3, P-5, P-5S, P-6, P-7, P-8 5.0, 9.0, 6.0, 1.0, 3.0, 1.0, 2.0
December 1988	P-3, P-6, P-8 0.5, 0.6, 0.7
***Trans 1,2-Dichloroethylene (Trans 1,2-Dichloroethylene)** (NO MCL) (ug/l)	
December 1987	P-5, P-5S, 280, 22
June 1988	P-5, 287
August 1988	P-5, P-5S, 248, 2
December 1988	P-5, P-5S, 310, 14

TABLE 6 (continued)
DATA SUMMARY OF PARAMETERS
EXCEEDING MCL IN WELLS FROM 1988 AND 1989

PARAMETERS (MCL)	WELLS/CONCENTRATION (IN ORDER)
***Vinyl Chloride** (2ug/l)	
December 1987	P-5, P-5S, 71, 62
December 1988	P-5, P-5S, 39, 26
***Trichloroethylene** = **(Trichloroethane)** (ug/l)	
December 1987	P-5, 380
March 1988	P-5, 250
August 1988	P-5, 294
December 1988	P-5, 500
***Trans 1,2-Dichloroethane** (5 ug/l)	
- March 1988	P-5S, 11

This is the only sampling event which included this parameter

*No Sampling was conducted after December 1988

TABLE 7
SUMMARY OF INTERIM STATUS STATISTICAL DETERMINATIONS

Sampling Date	Well	Tox	Toc	PH	S.C.
6/16/87	P-6	+	+	-	-
	P-1	-	+	-	+
	P-2	-	+	-	-
	P-5	+	+	-	+
8/25/87	P-6	-	+	-	-
	P-1	-	+	-	+
	P-2	-	+	-	-
	P-5	+	+	-	+
12/15/87	P-6	-	+	-	-
	P-1	+	+	-	+
	P-2	+	+	-	-
	P-5	+	+	-	+
3/22/88	P-1	-	+	-	+
	P-2	-	-	-	-
	P-3	-	+	-	+
	P-5S	+	+	-	-
	P-5	+	+	-	+
	P-6	-	+	-	-
	P-7	-	-	-	-
	P-8	-	+	-	-
6/28/88	P-1	-	+	-	+
	P-2	-	+	-	-
	P-3	-	+	-	+
	P-5S	+	+	-	-
	P-5	+	+	-	+
	P-6	-	+	-	-
	P-7	-	+	-	-
	P-8	-	+	-	-
8/31/88	P-1	-	+	-	+
	P-2	-	+	-	-
	P-3	-	+	-	+
	P-5S	-	+	-	+
	P-5	+	+	-	+
	P-6	-	+	-	-
	P-7	-	+	-	-
	P-8	-	+	-	-

TABLE 7 (continued)

Sampling Date	Well	Tox	Toc	PH	S.C.
12/29/88	P-1	-	+	-	+
	P-2	-	+	-	-
	P-3	-	+	-	+
	P-5S	-	+	-	+
	P-5	+	+	-	+
	P-6	-	+	-	+
	P-7	-	+	-	+
	P-8	-	+	-	-
2/21/89	P-1				
	P-1T				
	P-2				
	P-2T				
	P-5				
	P-5S	Statistical analysis was not included			
	P-8				
	P-8T				
	P-11				
	P-7				
	P-7T				
5/31/89	P-1	-	+	-	+
	P-2	-	+	-	-
	P-5	+	+	-	+
	P-5S	+	+	-	+
	P-8	+	+	-	-
8/30/89	P-5S	+	+	-	+
	P-7	-	+	-	-
	P-8	-	+	-	-
	P-11	-	+	-	-
11/21/89	P-1				
	P-1T				
	P-2				
	P-2T				
	P-5				
	P-5S	Statistical analysis was not included			
	P-7				
	P-7T				
	P-8F				
	P-T				
	P-11				

* The 1989 annual report will be submitted the week of February 12, 1990.
+ Statistically significant change from baseline
- No Statistically significant change from baseline

VIII. COMPLIANCE STATUS SUMMARY:

As a result of this comprehensive ground water monitoring evaluation, violations and deficiencies of the Ohio Administrative Code rules 3745-65-90 through 3745-65-94 been identified. Each violation is cited below, and a brief corresponding explanation of the nature of the violation is also provided. For additional information, the attached RCRA checklists should be consulted. All citations are based State statutes.

VIOLATIONS:

OAC 3745-65-92 (B)(1)

GMC Fisher did not sample for Gross alpha, Gross Beta or Radium during the May and December 1989 quarterly sampling events in the newly installed shallow monitoring wells to establish background water quality as required per OAC rule 3745-65-92(B)(1). Turbidity was not sampled for in all newly installed shallow monitoring wells during May, August, and December 1989 quarterly sampling events as required by OAC 3745-65-92(B)(1).

OAC 3745-65-94 (A)(1)

The company did not submit a 1988 annual ground water report to the Ohio EPA by March 1, 1989 as required per OAC rule 3745-65-75. The ground water monitoring data collected during the 1988 calendar year however, was submitted to the Ohio EPA with the 1989 annual ground water report.

DEFICIENCIES:

1. The company's current sampling analysis plan and field procedures are presented in the its Post Closure Permit Application. The sampling and analysis plan and field procedures were evaluated by the Ohio EPA in accordance with OAC rule 3745-65-92 (A). Upon evaluation, the sampling and analysis plan and field procedures were determined to contain the following deficiencies:

    a. The proposed wetted tape method for measuring ground water levels is not recommended. A mechanical sounding device is acceptable and the electric water level meter is highly recommended.

    b. The facility should use a sampling line that is made of inert material, such as a teflon coated tape. The plan should also indicate the rate of flow for the pump(s) used in the process.

    c. It is recommended to collect the sample using a bottom emptying bailer instead of a top emptying bailer to minimize sample agitation.

d. The SAP does not contain a decontamination procedure that should be followed by the consultant during sampling events.

e. The facility must indicate the type of filtration equipment and method that will be used.

f. Table E-13 of Reference #7 is not accurate. We recommend that newer editions of SW-846 be used as well as the Technical Enforcement Guidance Document (TEGD) for guide line and accurate information for test methods and reference.

g. An evaluation of table E-14 (Analytical Methods), of the Post Closure Application of November 1988, noted that sodium and sulfate referenced method EPA 273.1 and EPA 325.2 that are different than referenced in the SAP (EPA 200.7 and EPA 357.1).

h. There is no method reference given for Total Organic Halogens in Table E-14 of Reference #7.

2. The facility must provide an updated ground water quality assessment outline in to comply with the OAC rule 3745-65-93 (A). The company has previously conducted a ground water quality assessment for the monitoring wells associated with the hazardous waste surface impoundment that has been closed as a hazardous waste landfill and determined that the unit has not affected ground water. A ground water quality assessment outline must be submitted as part of the detection monitoring system to meet the requirements of OAC rule 3745-65-93(A). The ground water quality assessment plan outline can be based upon the previous ground water quality assessment plan.

APPENDIX A

CHECKLISTS

APPENDIX A

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION WORKSHEET

The following worksheets have been designed to assist the enforcement officer/ technical reviewer in evaluating theground-water monitoring system an owner/operator uses to collect and analyze samples of ground water. The focus of the worksheets is technical adequacy as it relates to obtaining and analyzing representative samples of ground water. The basis of the worksheets is the final RCRA Ground Water Monitoring Technical Enforcement Guidance Document which describes in detail the aspects of ground-water monitoring which EPA deems essential to meet the goals of RCRA. Appendix A is not a regulatory checklist. Specific technical deficiencies in the monitoring system can, however, be related to the regulations as illustrated in Figure 4.3 taken from the RCRA Ground-Water Monitoring Compliance Order Guide (COG) (included at the end of the appendix). The enforcement officer, in developing an enforcement order, should relate the technical assessment from the worksheets to the regulations using Figure 4.3 from the COG as a guide.

Comprehensive Ground-Water Monitoring Evaluation	Y/N
I. Office Evaluation Technical Evaluation of the Design of the Ground-Water Monitoring System	
A. Review of Relevant Documents	
1. What documents were obtained prior to conducting the inspection:	
a. RCRA Part A permit application?	Y
b. RCRA Part B permit application?	Y
c. Correspondence between the owner/operator and appropriate agencies or citizen's groups?	Y
d. Previously conducted facility inspection reports?	Y
e. Facility's contractor reports?	Y
f. Regional hydrogeologic, geologic, or soil reports?	Y
g. The facility's Sampling and Analysis Plan?	Y
h. Ground-water Assessment Program Outline (or Plan, if thefacility is in assessment monitoring)?	Y
i. Other (specify) A Post-closure Application	

	Y/N
B. Evaluation of the Owner/Operator's Hydrogeologic Assessment 1. Did the owner/operator use the following direct techniques in the hydrogeologic assessment:	
a. Logs of the soil borings/rock corings (documented by a professional geologist, soil scientist, or geotechnical engineer)?	Y
b. Materials tests (e.g., grain size analyses, standard penetration tests, etc.)?	N
c. Piezometer installation for water level measurments at different depths?d. Slug tests?	N/Y
e. Pump tests?	N
f. Geochemical analyses of soil samples?	Y
g. Other (specify) (e.g., hydrochemical diagrams and wash analysis)	N
2. Did the owner/operator use the following indirect technique to supplement direct techniques data:	
a. Geophysical well logs?	N
b. Tracer studies?	N
c. Resistivity and/or electromagnetic conductance?	Y
d. Seismic Survey?	N
e. Hydraulic conductivity measurements of cores?	N
f. Aerial photography?	N
g. Ground penetrating radar?	N
h. Other (specify)	
3. Did the owner/operator document and present the raw data from the site hydrogeologic assessment?	Y
4. Did the owner/operator document methods (criteria) used to correlate and analyze the information?	N
5. The owner/operator prepare the following:	
a. Narrative description of geology?	Y
b. Geologic cross sections? * Poorly conducted	Y
c. Geologic and ~~soil~~ maps?	Y
d. Boring/coring logs?	Y
e. Structure contour maps of the differing water bearing zones and confining layer?	Y
f. Narrative description and calculation of ground-water flows?	Y

	Y/N
g. Water table/potentiometric map?	Y
h. Hydrologic cross sections?	N
6. Did the owner/operator obtain a regional map of the area and delineate the facility?	
If yes, does this map illustrate: a. Surficial geology features?	Y
b. Streams, rivers, lakes, or wetlands near the facility?	Y
c. Discharging or recharging wells near the facility?	Y
7. Did the owner/operator obtain a regional hydrogeologic map?	
If yes, does this hydrogeologic map indicate: a. Major areas of recharge/discharge?	N
b. Regional ground-water flow direction?	N
c. Potentiometric contours which are consistent with observed water level elevations?	N
8. Did the owner/operator prepare a facility site map?	Y
If yes, does the site map show: a. Regulated units of the facility (e.g., landfill areas.impoundments)?	N
b. Any seeps, springs, streams, ponds, or wetlands?	
c. Location of monitoring wells, soil borings, or test pits?	Y
d. How many regulated units does the facility have? Presently (one)	1
If more than one regulated unit then, • Does the waste management area encompass all regulated units?	
• Is a waste management area delineated for each regulated unit?	
C. Characterization of Subsurface Geology of Site 1. Soil boring/test pit program:	
a. Were the soil borings/test pits performed under thesupervision of a qualified professional?	Y
b. Did the owner/operator provide documentation for selecting the spacing for borings? Because The Facility was in Assessment	Y
c. Were the borings drilled to the depth of the first confining unit below the uppermost zone of saturation or ten feet into bedrock? * One boring was drilled 10.0' Below the Aquifer Zone.	Y
d. Indicate the method(s) of drilling:	

	Y/N
Auger (hollow or solid stem) __X__ Mud rotary ____ Reverse rotary ____ Cable tool ____ Jetting ____ Other (specify) ________	Y
e. Were continuous sample corings taken?	Y
f. How were the samples obtained (checked method[s]) • Split spoon __X__ • Shelby tube, or similar ____ • Rock coring __X__ • Ditch sampling ____ • Other (explain) ________	
g. Were the continuous sample corings logged by a qualified professional in geology?	Y
h. Does the field boring log include the following information: • Hole name/number?	Y
• Date started and finished?	Y
• Driller's name?	Y
• Hole location (i.e., map and elevation)? Some had location, others did not and most logs did not have elevation.	Y & N
• Drill rig type and bit/auger size?	Y
• Gross petrography (e.g., rock type) of each geologic unit?	N
• Gross mineralogy of each geologic unit?	N
• Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or valleys, identification of depositional material)?	N
• Development of soil zones and vertical extent and description of soil type?	[illegible]
• Depth of water bearing unit(s) and vertical extent of each?	Y
• Depth and reason for termination of borehole? (No reason of termination was given)	Y
• Depth and location of any contaminant encountered in borehole?	Y
• Sample location/number?	Y
• Percent sample recovery?	Y
• Narrative descriptions of: —Geologic observations?	N
—Drilling observations?	Y
i. Were the following analytical tests performedon the core samples: • Mineralogy (e.g., microscopic tests and x-ray diffraction)?	N
• Petrographic analysis: —degree of crystallinity and cementation of matrix?	N
—degree of sorting, size fraction (i.e., sieving), textural variations?	N
—rock type(s)?	N

	Y/N
—soil type?	N
—approximate bulk geochemistry?	N
—existence of microstructures that may effect or indicate fluid flow?	N
• Falling head tests?	Y
• Static head tests?	N
• Settling measurements?	N
• Centrifuge tests?	N
• Column drawings?	N
D. Verification of Subsurface Geological Data	
1. Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations?	Y
2. Do the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically low water-bearing units?	Y
3. Is the confining layer laterally continuous across the entire site? The Shale layer below the Berea Sand Stone	Y
4. Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layer?	Y
5. Did the geologic assessment address or provide means for resolution of any information gaps of geologic data?	Y
6. Do the laboratory data corroborate the field data for petrography? * NONE was conducted	N/A
7. Do the laboratory data corroborate the field data for mineralogy and subsurface geochemistry?	NA
E. Presentation of Geologic Data	
1. Did the owner/operator present geologic cross sections of the site? * Poorly Done	Y
2. Do cross sections:	
a. identify the types and characteristics of the geologic materials present?	Y
b. define the contact zones between different geologic materials?	Y
c. note the zones of high permeability or fracture?	N
d. give detailed borehole information including:	

	Y/N
• location of borehole?	Y
• depth of termination?	Y
• location of screen (if applicable)?	Y
• depth of zone(s) of saturation?	Y
• backfill procedure?	N
3. Did the owner/operator provide a topographic map which was constructed by a licensed surveyor?	N
4. Does the topographic map provide: a. contours at a maximum interval of two-feet?	N
b. locations and illustrations of man-made features (e.g., parking lots, factory buildings, drainage ditches, storm drain, pipelines, etc.)?	N
c. descriptions of nearby water bodies?	N
d. descriptions of off-site wells?	N
e. site boundaries? * Illustrated on a site Plan	Y
f. individual RCRA units? * obtained From CME (1987).	Y
g. delineation of the waste management area(s)?	Y
h. well and boring locations? * on a Separate Figure	Y
5. Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features?	N
6. Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labelled?	N/A
F. Identification of Ground-Water Flowpaths 1. Ground-water flow direction a. Was the well casing height measured by a licensed surveyor to the nearest 0.01 feet? *However, the surveyor name was never submitted.	Y
b. Were the well water level measurements taken within a 24 hour period?	Y
c. Were the well water level measurements taken to the nearest 0.01 feet?	Y
d. Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements?	UNK
e. Was the water level information obtained from (check appropriate one): • multiple piezometers placed in single borehole? ____ • vertically nested piezometers in closely spaced separate ____ • boreholes? ____ • monitoring wells? X	

	Y/N
f. Did the owner/operator provide construction details for the piezometers?	Y
g. How were the static water levels measured (check method[s]). • Electric water sounder X • Wetted tape X • Air line ___ • Other (explain) ___	
h. Was the well water level measured in wells with equivalent screened intervals at an equivalent depth below the saturated zone? * Most measurements were in feet of water depth from top of casing not elevation.	Y
i. Has the owner/operator provided a site water table (potentiometric) contour map?	Y
If yes, • Do the potentiometric contours appear logical and accurate based on topography and presented data? (Consult water level data)	Y
• Are ground-water flow-lines indicated?	Y
• Are static water levels shown?	Y
• Can hydraulic gradients be estimated?	Y
j. Did the owner/operator develop hydrologic cross sections of the vertical flow component across the site using measurements from all wells?	N
k. Do the owner/operator's flow nets include: • piezometer locations?	NA
• depth of screening?	
• width of screening?	
• measurements of water levels from all wells and piezometers?	
2. Seasonal and temporal fluctuations in ground-water a. Do fluctuations in static water levels occur? If yes, are the fluctuations caused by any of the following: * It was not determined by the facility.	Y
—Off-site well pumping	N
—Tidal processes or other intermittent natural variations (e.g., river stage, etc.)	N
—On-site well pumping	N
—Off-site, on-site construction or changing land use patterns	Y
—Deep well injection	N
—Seasonal variations	UNK
—Other (specify) ___	N
b. Has the owner/operator documented sources and patterns that contribute to or affect the ground-water patterns below the waste management?	Y
c. Do water level fluctuations alter the general ground-water gradients and flow directions? * Appears that the Aquifer is an arteasin aquifer.	Y
d. Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone? * up ward if any.	Y

*1

	Y/N
e. Did the owner/operator implement means for gauging long term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns?	N
3. Hydraulic conductivity a. How were hydraulic conductivities of the subsurface materials determined?	Y
• Single-well tests (slug tests)?	Y
• Multiple-well tests (pump tests)	N
• Other (specify) ________	N
b. If single-well tests were conducted, was it done by: • Adding or removing a known volume of water? Removing	Y
• Pressurizing well casing?	N
c. If single well tests were conducted in a highly permeable formation, were pressure transducers and high-speed recording equipment used to record the rapidly changing water levels?	N
d. Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit? * only in the Berea Sandstone Unit.	Y
e. Is the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)?	Y
f. Were other hydraulic conductivity properties determined?	N
g. If yes, provide any of the following data, if available: • Transmissivity N • Storage coefficient N • Leakage N • Permeability Y • Porosity N • Specific capacity N • Other (specify) Ground Water flow rate using An assumed Porosity and an average permeability	
4. Identification of the uppermost aquifer a. Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? If yes,	Y
• Are soil boring/test pit logs included?	Y
• Are geologic cross-sections included?	Y
b. Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? If yes,	Y
• how was continuity demonstrated? A 10 foot Rock Core of the Bedford Shale	
c. What is hydraulic conductivity of the confining unit (if present)? CM/Sec How was it determined?	UNK

	Y/N
d. Does potential for other hydraulic communication exist (e.g., lateral incontinuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachage? If yes or no, what is the rationale? There is only one Hydrogeologic Zone, which is presented by The Berea Sandstone.	Y
G. Office Evaluation of the Facility's Ground-Water Monitoring System—Monitoring Well Design and Construction: These questions should be answered for each different well design present at the facility. 1. Drilling Methods a. What drilling method was used for the well? • Hollow-stem auger ☒ • Solid-stem auger ☐ • Mud rotary ☐ • Air rotary ☐ • Reverse rotary ☐ • Cable tool ☐ • Jetting ☐ • Air drill w/ casing hammer ☐ • Other (specify) Water Rotary	
b. Were any cutting fluids (including water) or additives used during drilling? If yes, specify: • Type of drilling fluid water for Rock coring • Source of water used The Facility • Foam ____ • Polymers ____ • Other ____	
c. Was the cutting fluid, or additive, identified?	NA
d. Was the drilling equipment steam-cleaned prior to drilling the well? • Other methods ____	Y
e. Was compressed air used during drilling? If yes, • was the air filtered to remove oil?	N
f. Did the owner/operator document procedure for establishing the potentiometric surface? If yes, • how was the location established? * wetted tape and/or Electric Sounder	Y
g. Formation samples	

	Y/N
• Were formation samples collected initially during drilling?	Y
• Were any cores taken continuous? ROCK Cores	Y
• If not, at what interval were samples taken? Soil Samples at 2.5 feet	
• How were the samples obtained? X Split spoon —Shelby tube X Core drill —Other (specify)	
• Identify if any physical and/or chemical tests were performed on the formation samples (specify) CEC = Cation Exchange Capacity was performed on three samples from P-1T, P-7T and P-8T at depths which correspond with the bottom of the landfill.	
2. Monitoring Well Construction Materials P-1 Through P-6 was conducted in 1987 CME. P-4R, P-5S, P-7, P-7T, P-8, P-8T, P-9, P-10, P-11, P-1T, P-2T a. Identify construction materials (by number) and diameters (ID/OD) Material / Diameter ~~Primary Casing~~ — Stainless Steel — 2.0" (PVC For P-1, P-7T, P-8T, P-2T, P-8, P-11) • Secondary or outside casing (doubleconstruction) — Steel — 6.0" • Screen (P-1, P-7T, P-1T, P-2T, P-8T, P-11) — PVC/Stainless Steel — 2.0"	
b. How are the sections of casing and screen connected? • Pipe sections threaded	Y
• Couplings (friction) with adhesive or solvent	N
• Couplings (friction) with retainer screws	N
• Other (specify)	N
c. Were the materials steam-cleaned prior to installation? • If no, how were the materials cleaned? ________	Y
3. Well Intake Design and Well Development a. Was a well intake screen installed?	Y
• What is the length of the screen for the well? 5.0 feet	
• Is the screen manufactured? Yes	Y
b. Was a filter pack installed?	Y
• What kind of filter pack was employed? #4 Coarse Sand	
• Is the filter pack compatible with formationmaterials?	Y
• How was the filter pack installed? ________	UNK

	Y/N
• What are the dimensions of the filter pack? Screen length + 2 to 3 feet above Screen	
• Has a turbidity measurement of the well water ever been made? Some of them	Y
• Have the filter pack and screen been designed for the insitu materials?	N
c. Well development • Was the well developed?	Y
• What technique was used for well development? —Surge block X Bailer —Air surging X Water pumping —Other (specify) ______	
4. Annular Space Seals a. What is the annular space in the saturated zone directlyabove the filter pack filled with: X Sodium bentonite (specify type and grit) —Cement (specify neat or concrete) —Other (specify)	
b. Was the seal installed by: —Dropping material down the hole and tamping —Dropping material down the inside of hollow-stem auger X Tremie pipe method ← —Other (specify)	
c. Was a different seal used in the unsaturated zone? If yes,	Y
• Was this seal made with? —Sodium bentonite (specify type and grit) —Cement (specify neat or concrete)- Other (specify) Cement/Bentonite Mix	
• Was this seal installed by? —Dropping material down the hole and tamping —Dropping material down the inside of hollow stem auger —Other (specify)	
d. Is the upper portion of the borehole sealed with a concrete cap to prevent infiltration from the surface?	Y
e. Is the well fitted with an above-ground protectivedevice and bumper guards?	Y / N
f. Has the protective cover been installed with locks to prevent tampering?	Y

	Y/N
H. Evaluation of the Facility's Detection Monitoring Program 1. Placement of Downgradient Detection Monitoring Wells * This is for the post-closure Monitoring system which is implemented after July 1988. This date designate a Return to Detection Monitoring. a. Are the ground-water monitoring wells or clusters located immediately adjacent to the waste management area?	Y
b. How far apart are the detection monitoring wells?	
c. Does the owner/operator provide a rationale for thelocation of each monitoring well or cluster?	Y
d. Does the owner/operator identified the well screenlengths of each monitoring well or clusters?	Y
e. Does the owner/operator provide an explanation for the well screen lengths of each monitoring well orcluster? * as per approved closure Plan	Y
f. Do the actual locations of monitoring wells orclusters correspond to those identified by the owner/operator?	Y
2. Placement of Upgradient Monitoring Wells a. Has the owner/operator documented the location ofeach upgradient monitoring well or cluster?	Y
b. Does the owner/operator provide an explanation forthe location(s) of the upgradient monitoring wells?	Y
c. What length screen has the owner/operator employed inthe background monitoring well(s)? * It was not used for statistical analysis yet.	Y
d. Does the owner/operator provide an explanation for the screen length(s) chosen?	Y
e. Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator?	UNK
I. Office Evaluation of the Facility's Assessment Monitoring Program * An assessment was conducted during 1987. The Results of the assessment which were submitted to Ohio EPA in Feb. 1988, show no Release from the Former Surface Impoundments - The Assessment Report was approved in July 1988, and the facility was Returned to a detection system (presently post-closure system). 1. Does the assessment plan specify: a. The number, location, and depth of wells? The post-closure does not inlclude an assessment outline.	NA
b. The rationale for their placement and identify the basis that will be used to select subsequent sampling locations and depths in later assessment phases?	NA
2. Does the list of monitoring parameters include all hazardous waste constituents from the facility?	NA

*2

	Y/N
a. Does the water quality parameter list include other important indicators not classified as hazardous waste constituents?	N/A
b. Does the owner/operator provide documentation for he listed wastes which are not included?	
3. Does the owner/operator's assessment plan specify the procedures to be used to determine the rate of constituent migration in the ground-water?	
4. Has the owner/operator specified a schedule of implementation in the assessment plan?	
5. Have the assessment monitoring objectives been clearly defined in the assessment plan?	
a. Does the plan include analysis and/or re-evaluation to determine if significant contamination has occurredin any of the detection monitoring wells?	
b. Does the plan provide for a comprehensive program of investigation to fully characterize the rate and extent of contaminant migration from the facility?	
c. Does the plan call for determining the concentrations of hazardous wastes and hazardous waste constituentsin the ground water?	
d. Does the plan employ a quarterly monitoring program?	
6. Does the assessment plan identify the investigatory methods that will be used in the assessment phase?	
a. Is the role of each method in the evaluation fully described?	
b. Does the plan provide sufficient descriptions of the direct methods to be used?	
c. Does the plan provide sufficient descriptions of the indirect methods to be used?	
d. Will the method contribute to the further characterization of the contaminant movement?	
7. Are the investigatory techniques utilized in the assessment program based on direct methods?	
a. Does the assessment approach incorporate indirect methods to further support direct methods?	
b. Will the planned methods called for in the assessment approach ultimately meet performance standards for assessment monitoring?	
c. Are the procedures well defined?	
d. Does the approach provide for monitoring wells similar in design and construction as the detectionmonitoring wells?	

	Y/N
e. Does the approach employ taking samples during drilling or collecting core samples for further analysis?	N/A
8. Are the indirect methods to be used based on reliable and accepted geophysical techniques?	
a. Are they capable of detecting subsurface changesresulting from contaminant migration at the site?	
b. Is the measurement at an appropriate level of sensitivity to detect ground-water quality changes at the site?	
c. Is the method appropriate considering the nature of the subsurface materials?	
d. Does the approach consider the limitations of these methods?	
e. Will the extent of contamination and constituent concentration be based on direct methods and sound engineering judgment? (Using indirect methods tofurther substantiate the findings.)	
9. Does the assessment approach incorporate any mathe-matical modeling to predict contaminant movement?	
a. Will site specific measurements be utilized toaccurately portray the subsurface?	
b. Will the derived data be reliable?	
c. Have the assumptions been identified?	
d. Have the physical and chemical properties of the site-specific wastes and hazardous waste constituentsbeen identified?	✓
J. Conclusions	
1. Subsurface geology	
a. Has sufficient data been collected to adequately define petrography and petrographic variation?	N
b. Has the subsurface geochemistry been adequately defined?	N
c. Was the boring/coring program adequate to definesubsurface geologic variation?	Y
d. Was the owner/operator's narrative description complete and accurate in its interpretation of the data?	Y
e. Does the geologic assessment address or provide means to resolve any information gaps?	Y
2. Ground-water flowpaths	Horizontal only
a. Did the owner/operator adequately establish the hori-zontal and vertical components of ground-water flow?	

	Y/N
b. Were appropriate methods used to establish ground-water flowpaths?	Y
c. Did the owner/operator provide accurate documentation?	Y
d. Are the potentiometric surface measurements valid?	
e. Did the owner/operator adequately consider the seasonal and temporal effects on the ground-water?	N
f. Were sufficient hydraulic conductivity tests performed to document lateral and vertical variationin hydraulic conductivity in the entire hydrogeologic subsurface below the site?	Y
3. Uppermost Aquifer a. Did the owner/operator adequately define the upper-most aquifer?	Y
4. Monitoring Well Construction and Design a. Do the design and construction of the owner/operator's ground-water monitoring wells permit depth discrete ground-water samples to be taken?	Y
b. Are the samples representative of ground-water quality?	Y
c. Are the ground-water monitoring wells structurally stable? except for P-1	Y
d. Does the ground-water monitoring well's design and construction permit an accurate assessment of aquifer characteristics?	Y
5. Detection Monitoring a. Downgradient Wells • Do the location, and screen lengths of the ground-water monitoring wells or clusters in the detection monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer?	Y *3
b. Upgradient Wells • Do the location and screen lengths of the upgradient (background) ground-water monitoring wells ensure the capability of collecting ground-water samples representative of upgradient (background) ground-water quality including any ambient heterogenous chemical characteristics?	Y
6. Assessment Monitoring a. Has the owner/operator adequately characterized site hydrogeology to determine contaminant migration?	NA *2
b. Is the detection monitoring system adequately designed and constructed to immediately detect any contaminant release?	↓

	Y/N
c. Are the procedures used to make a first determinationof contamination adequate?	
d. Is the assessment plan adequate to detect, characterize, and track contaminant migration?	
e. Will the assessment monitoring wells, given site hydrogeologic conditions, define the extent and concentration of contamination in the horizontal and vertical planes?	
f. Are the assessment monitoring wells adequately designed and constructed?	
g. Are the sampling and analysis procedures adequate to provide true measures of contamination?	
h. Do the procedures used for evaluation of assessment monitoring data result in determinations of the rate of migration, extent of migration, and hazardous constituent composition of the contaminant plume?	
i. Are the data collected at sufficient frequency and duration to adequately determine the rate of migration?	
j. Is the schedule of implementation adequate?	
k. Is the owner/operator's assessment monitoring plan adequate?	
• If the owner/operator had to implement hisassessment monitoring plan, was it implemented satisfactorily?	

II. Field Evaluation

A. Ground-Water Monitoring System

1. Are the numbers, depths, and locations of monitoring wells in agreement with those reported in the facility's monitoring plan? (See Section 3.2.3.)	Y

B. Monitoring Well Construction

1. Identify construction material material diameter

a. Primary Casing PVC/Steel

b. Secondary or outside casing Steel

2. Is the upper portion of the borehole sealed with conrete to prevent infiltration from the surface? * Some of them are broken [illegible] repair	Y
3. Is the well fitted with an above-ground protective device?	Y
4. Is the protective cover fitted with locks to prevent tampering? If a facility utilizes more than a single well design, answer the above questions for each well design?	Y

	Y/N
III. Review of Sample Collection Procedures	
A. Measurement of Well Depths /Elevation	
1. Are measurements of both depth to standing water and depth to the bottom of the well made?	Y
2. Are measurements taken to the 0.01 feet?	N
3. What device is used? wetted tape w/ a weight.	
4. Is there a reference point established by a licensed surveyor?	Y
5. Is the measuring equipment properly cleaned betweenwll locations to prevent cross contamination?	N
B. Detection of Immiscible Layers	
1. Are procedures used which will detect light phase immiscible layers?	N
2. Are procedures used which will detect heavy phase immiscible layers?	Y
C. Sampling of Immiscible Layers	
1. Are the immiscible layers sampled separately prior to well evacuation?	N
2. Do the procedures used minimize mixing with watersoluble phases?	N
D. Well Evacuation	
1. Are low yielding wells evacuated to dryness?	Y
2. Are high yielding wells evacuated so that at least three casing volumes are removed?	Y
3. What device is used to evacuate the wells? Teflon Bailer w/teflon Robe	Y
4. If any problems are encountered (e.g., equipmentmalfunction) are they noted in a field logbook?	Y

	Y/N
E. Sample Withdrawal	
1. For low yielding wells, are samples for volatiles, pH, and oxidation/reduction potential drawn first after the well recovers?	Y
2. Are samples withdrawn with either flurocarbon/resins or stainless steel (316, 304 or 2205) sampling devices?	N
3. Are sampling devices either bottom valve bailers or ~~positive gas displacement bladder pumps~~?	Y
4. If bailers are used, is fluorocarbon/resin coated wire, single strand stainless steel wire, or monofilament used to raise and lower the bailer?	Y
5. If bladder pumps are used, are they operated in acontinuous manner to prevent aeration of the sample?	NA.
6. If bailers are used, are they lowered slowly to prevent degassing of the water?	Y
7. If bailers are used, are the contents transferred to the sample container in a way that minimizes agitation and aeration?	N
8. Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to insertion into the well?	N
9. If dedicated sampling equipment is not used, is equipment disassembled and thoroughly cleaned between samples?	Y
10. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps:	
a. Dilute acid rinse (HNO_3 or HC1)?11. If samples are for organic analysis, does the cleaning procedure include the following sequential steps:	N
11. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps:	
a. Nonphosphate detergent wash?	Y
b. Tap water rinse?	~~N~~
c. Distilled/deionized water rinse?	Y
d. Acetone rinse?	N
e. Pesticide-grade hexane rinse?	N

	Y/N
12. Is sampling equipment thoroughly dry before use?	N
13. Are equipment blanks taken to ensure that sample cross-contamination has not occurred?	N
14. If volatile samples are taken with a positive gas displacement bladder pump, are pumping rates below 100 ml/min? * no Voc taken at this time.	NA
F. In-situ or Field Analyses	
1. Are the following labile (chemically unstable) parameters determined in the field:	
a. pH?	Y
b. Temperature?	N
c. Specific conductivity?	Y
d. Redox potential?	N
e. Chlorine?	N
f. Dissolved oxygen?	N
g. Turbidity?	N
h. Other (specify) ______	N
2. For in-situ determinations, are they made after well evacuation and sample removal?	Y
3. If sample is withdrawn from the well, is parameter measured from a split portion?	Y
4. Is monitoring equipment calibrated according to mannufacturers' specifications and consistent with SW-846?	Y
5. Is the date, procedure, and maintenance for equipment calibration documented in the field logbook? * However, They are Clibrated in the field.	N
IV. Review of Sample Preservation and Handling Procedures	
A. Sample Containers	
1. Are samples transferred from the sampling device directly to their compatible containers?	Y

	Y/N
2. Are sample containers for metals (inorganics) analyses polyethylene with polypropylene caps?	N
3. Are sample containers for organics analysis glass bottles with fluorocarbonresin-lined caps?	Y
4. If glass bottles are used for metals samples are the caps fluorocarbonresin-lined?	Y
5. Are the sample containers for metal analyses cleanedusing these sequential steps: * They are clean and new. No dusting is done	
a. Nonphosphate detergent wash?	N
b. 1:1 nitric acid rinse?	N
c. Tap water rinse?	N
d. 1:1 hydrochloric acid rinse?	N
e. Tap water rinse?	N
f. Distilled/deionized water rinse?	N
6. Are the sample containers for organic analyses cleaned using these sequential steps: * They were obtained clean	
a. Nonphosphate detergent/hot water wash?	N
b. Tap water rinse?	N
c. Distilled/deionized water rinse?	N
d. Acetone rinse?	N
e. Pesticide-grade hexane rinse?	N
7. Are trip blanks used for each sample container type to verify cleanliness?	N
B. Sample Preservation Procedures	
1. Are samples for the following analyses cooled to 4°C:	
a. TOC?	Y
b. TOX?	Y
c. Chloride?	Y
d. Phenols?	Y
e. Sulfate?	Y
f. Nitrate?	NA
g. Coliform bacteria?	NA
h. Cyanide?	NA
i. Oil and grease?	NA
j. Hazardous constituents (261, Appendix VIII)?	NA

	Y/N
2. Are samples for the following analyses field acidified to pH <2 with HNO_3:	
a. Iron?	Y
b. Manganese?	Y
c. Sodium?	Y
d. Total metals?	N
e. Dissolved metals?	Y
f. Fluoride?	N
g. Endrin?	N
h. Lindane?	N
i. Methoxychlor?	N
j. Toxaphene?	N
k. 2,4, D?	N
l. 2,4,5 TP Silvex?	N
m. Radium?	N
n. Gross alpha?	N
o. Gross beta?	N
3. Are samples for the following analyses field acidfied to pH <2 with H_2SO_4:	
a. Phenols? used HCL	N
b. Oil and grease?	N
4. Is the sample for TOC analyses field acified to pH <2 with HCl?	Y
5. Is the sample for TOX analysis preserved with 1 ml of 1.1 M sodium sulfite?	N
6. Is the sample for cyanide analysis preserved with NaOH to pH >12?	N
C. Special Handling Considerations	
1. Are organic samples handled without filtering?	Y
2. Are samples for volatile organics transfered to the appropriate vials to eliminate headspace over the sample?	NA
3. Are samples for metal analysis split into two portions?	N
4. Is the sample for dissolved metals filtered through a 0.45 micron filter?	Y
5. Is the second portion not filtered and analyzed for total metals?	N
6. Is one equipment blank prepared each day of ground-water sampling?	Y

	Y/N
V. Review of Chain-of-Custody Procedures	
A. Sample Labels	
1. Are sample labels used? They are given a number with preservative that will be tracked in the Lab and the Log Book	N
2. Do they provide the following information:	
a. Sample identification number?	Y
b. Name of collector?	N
c. Date and time of collection?	N
d. Place of collection?	N
e. Parameter(s) requested and preservitives used?	N/Y
3. Do they remain legible even if wet?	UNK
B. Sample Seals	
1. Are sample seals placed on those containers to ensure samples are not altered?	N
C. Field Logbook	
1. Is a field logbook maintained?	Y
2. Does it document the following:	
a. Purpose of sampling (e.g., detection or assesment)?	
b. Location of well(s)?	N
c. Total depth of each well?	Y
d. Static water level depth and measurement technique?	Y
e. Presence of immiscible layers and detection method?	N
f. Collection method for immiscible layers and sample identification numbers?	Y
g. Well evacuation procedures?	Y
h. Sample withdrawal procedure?	Y
i. Date and time of collection? * Time is not recorded.	N
j. Well sampling sequence?	N
k. Types of sample containers and sample identification number(s)?	Y
l. Preservative(s) used? a liter	Y
m. Parameters requested?	N
n. Field analysis data and method(s)?	Y
o. Sample distribution and transporter?	N
p. Field observations?	N

	Y/N
—Unusual well recharge rates?	Y
—Equipment malfunction(s)?	Y
—Possible sample contamination?	N
—Sampling rate?	N
D. Chain-of-Custody Record 1. Is a chain-of-custody record included with each sample?	
2. Does it document the following: * These are filled out at the end of each day along w/ Sample Analysis Request Sheet. a. Sample number?	Y
b. Signiture of collector?	Y
c. Date and time of collection?	Y
d. Sample type?	✓
e. Station location?	✓
f. Number of containers?	Y
g. Parameters requested?	✓
h. Signatures of persons involved in chain-of-custody?	✓
i. Inclusive dates of custody?	Y
E. Sample Analysis Request Sheet 1. Does a sample analysis request sheet accompany each sample?	✓
2. Does the request sheet document the following: a. Name of person receiving the sample?	Y
b. Date of sample receipt?	✓
c. Duplicates?	✓
d. Analysis to be performed?	✓
IV. Review of Quality Assurance/Quality Control A. Is the validity and reliability of the laboratory and field generated data ensured by a QA/QC program?	Y
B. Does the QA/QC program include: 1. Documentation of any deviation from approved procedures?	Y

	Y/N
2. Documentation of analytical results for: a. Blanks?	Y
b. Standards?	Y
c. Duplicates?	Y
d. Spiked samples? * NOT DONE	N
e. Detectable limits for each parameter being analyzed?	Y
C. Are approved statistical methods used?	Y
D. Are QC samples used to correct data?	Y
E. Are all data critically examined to ensure it has been properly calculated and reported?	Y
VII. Surficial Well Inspection and Field Observation A. Are the wells adequately maintained?	N
B. Are the monitoring wells protected and secure?	N
C. Do the wells have surveyed casing elevations?	Y
D. Are the ground-water samples turbid?	Y
E. Have all physical characteristics of the site been noted in the inspector's field notes (i.e., surface waters, topography, surface features)?	Y
F. Has a site sketch been prepared by the field inspector with scale, north arrow, location(s) of buildings, location(s) of regulated units, locations of monitoring wells, and a rough depiction of the site drainage pattern?	Y

	Y/N
VIII. Conclusions	
A. Is the facilitycurrently operating under the correct monitoring progaram according to the statistical analyses performed by the current operator?	Y
B. Does the ground-water monitoring system, as designed and operated, allow for detection or assessment of any possible ground-water contamination caused by the facility?	Y & N *
C. Does the sampling and analysis procedures permit the owner/operator to detect and, where possible, assess the nature and extent of a release of hazardous constituents to ground water from the monitored hazardous waste management facility? This due to the inefficacy of Sampling techniques.	N **

* The detection monitoring system during the post closure period is adequate, yet the system is not capable of Assessing the extent and rate of VOC that exists in the ground water that is not Associated with the closed surface impoundment.

** The Sampling Analysis plan and field procedures ~~are~~ are deficient at the present time. (SEE Section VII of Text). However, Once ~~[illegible]~~ deficiencies are corrected, the plan will be adequate.

APPENDIX A-1

FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND-WATER MONITORING

Company Name: GMC Fisher, Elyria ; EPA I.D. Number: OHD 004201091

Company Address: 1400 Lowell Ave ; Inspector's Name: Ahmed Mustafa
Elyria, Ohio

Company Contact/Official: NONE From GMC was present ; 3 at OHM, Inc. ; Branch/Organization: Ohio EPA

Title: Sampling Consultant ; Date of Inspection: 2/21/1990

	Yes	No	Unknown
Type of facility: (check appropriately)			
a) surface impoundment		X	
b) landfill	X		
c) land treatment facility		X	
d) storage facility		X	

Ground-Water Monitoring Plan ☆ [The Evaluation is based on Post-closure Permit Application Monitoring System]

	Yes	No	Unknown
1. Has a ground-water monitoring plan been submitted to the Regional Administrator for facilities containing a surface impoundment, landfill, land treatment process, or storage facility?	Y		
2. Was the ground-water monitoring plan reviewed prior to site visit? If "No",	Y		
a) Was the ground-water plan reviewed at the facility prior to actual site inspection? If "No", explain.			

	Yes	No	Unknown
3. Has a ground-water monitoring program (capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility) been implemented? 265.90(a)	Y	___	___
4. Has at least one monitoring well been installed in the uppermost aquifer hydraulically upgradient from the limit of the waste management area? 265.91(a)(1)	Y	___	
a) Are sufficient ground-water samples from the uppermost aquifer, representative of background ground-water quality and not affected by the facility, ensured by proper well			
1) Number(s)?	Y	___	
2) Location?	Y	___	
3) Depth?	Y	___	
5. Have at least three monitoring wells been installed hydraulically downgradient at the limit of the waste handling or management area? 265.91(a)	Y	___	
6. Have the locations of the waste handling, storage, or disposal areas been verified to conform with information in the ground-water plan?	Y	___	___
7. Do the numbers, locations, and depths of the ground-water monitoring wells agree with the data in the ground-water monitoring system program? If "No", explain discrepancies.	___	N*	___

* Monitoring Wells P-7 and P-7T are located outside the fence, Mean While, The Map Show that these wells are insdie the Fence line

	Yes	No	Unknown
8. Has a ground-water sampling and analysis plan been developed? 265.92(a)	Y		
a) Has it been followed?		X	
b) Is the plan kept at the facility?		X	
c) Does the plan include procedures and techniques for:			
1) Sample collection?	Y ⊛		
2) Sample preservation?	Y		
3) Sample shipment?	Y		
4) Analytical procedures?	Y		
5) Chain of custody control?	Y		
9. Are the required parameters in ground-water samples planned to be tested quarterly for the first year? 265.92(b) and 265.92 (c)(1)	Y **		
a) Are the ground-water samples analyzed for the following:			
1) Parameters characterizing the suitability of the ground-water as a drinking supply? 265.92(b)(1)	Y **		
2) Parameters establishing ground-water qaulity? 265.92(b)(2)	Y		
3) Parameters used as indicators of ground-water contamination? 265.92(b)(2)	Y		
(i) Are at least four replicate measurements obtained for each sample? 265.92(c)(2)	Y		
(ii) Are provisions made to calculate the initial background arithmetic mean and variance of the respective parameter concentrations or values obtained from well(s) during the first year? 265.92(c)(2)	Y		
b) For facilities which have complied with first year ground-water sampling and analysis requirements:			
1) Have samples been obtained and analyzed for the ground-water qaulity parameters at least annually? 265.92(d)(1)	Y ***		
2) Have samples been obtained and analyzed for the indicators of ground-water contamination at least semi-annually? 265.92(d)(2)	Y		

⊛ The plan has few deficiencies that needs to be addressed. SEE TEXT.

** - Some parameters were not tested for in the Shallow Wells. SEE TEXT

*** - Deep Wells are already in this phase. Shallow Wells, Feb. 1990 Sampling is the first Semi-annual.

	Yes	No	Unknown
c) Were ground-water surface elevations determined at each monitoring well each time a sample was taken? 265.92(e)	Y*		
d) Were the ground-water surface elevations evaluated to determine whether the monitoring wells are properly placed? 265.93(f)	Y		
e) If it was determined that modification of the number, location or depth of monitoring wells was necessary, was the system brought into compliance with 265.91(a)? 265.93(f)			NA
10. Has an outline of a ground-water quality assessment program been prepared? 265.93(a)		N	
a) Does it describe a program capable of determining:			** NA
1) Whether hazardous waste or hazardous waste constituents have entered the ground water?			
2) The rate and extent of migration of hazardous waste or hazardous waste constituents?			
3) Concentrations of hazardous waste or hazardous waste constituents in in ground water?			
b) Have at least four replicate measurements of each indicator parameter been obtained for samples taken for each well? 265.93(b)			
1) Were the results compared with the initial background mean?			
(i) Was each well considered individually?			
(ii) Was the Student's t-test used (at the 0.01 level of significance)?			
2) Was a significant increase (or pH decrease) found in the:			
(i) Upgradient wells			
(ii) Downgradient wells			
If "Yes", Compliance Checklist A-2 must also be completed.			

* Ground Water Elevations were not always in feet above mean sea level.

** Because there is no outline, these questions can not be answered

	Yes	No	Unknown
11. Have records been kept of analyses for parameters establishing ground-water quality and indicators of ground-water contamination? 265.94(a)(1)	/		
12. Have records been kept of ground-water surface elevations taken at the time of sampling for each well? 265.94(a)(1)	Y		
13. Have the following been submitted to the Regional Administrator 265.94(a)(2) :			
a) Initial background concentrations of parameters listed in 265.92(b) within 15 days after completing each quarterly analysis required during the first year?		N	
b) For each well, any parameters whose concentrations or values have exceeded the maximum contaminant levels allowed in drinking water supplies?		N	
c) Annual reports including:			
1) Concentrations or values of parameters used as indicators of ground-water contamination for each well?	Y		
2) Results of the evaluation of ground-water surface elevations?	Y		

APPENDIX A COMMENTS

1. The majority of water level measurements which were submitted were in feet, indicating the depth from the top of the casing. However, some ground water levels were elevations in feet above mean sea level (MSL.)

2. A ground water assessment was conducted during 1987. The assessment results, which were submitted to the Agency in February 1988, show no release of hazardous waste or hazardous waste constituents from the former surface impoundments. The assessment report was approved in July 1988 and the facility was placed into a detection monitoring system (presently post-closure system), which will comply with OAC 3745-65-90 through OAC 3745-65-94 and the Closure Plan. However, when evaluating the Post-Closure Application, we noted that an assessment outline for the future detection system was not included. Therefore, I Section of I. Office Evaluation Technical Evaluation of the Design of the Ground Water Monitoring System of the Appendix A will not be answered.

3. The detection system implemented at the site consists of primarily P-1, P-1T, P-2, P-5, P-5S, P-7, P-7T, P-8, P-8T and P-11. These were included in Reference #5.

4. It must be noted that VOC's contamination source, which exists in the ground water, was not determined and concluded in the assessment report that VOC's were not released from the hazardous waste unit (former surface impoundments). The facility did not demonstrate the reason for VOC's presence beneath the existing landfill, and did not determine the rate, extent and concentration of these contaminants.

APPENDIX B

FIGURES

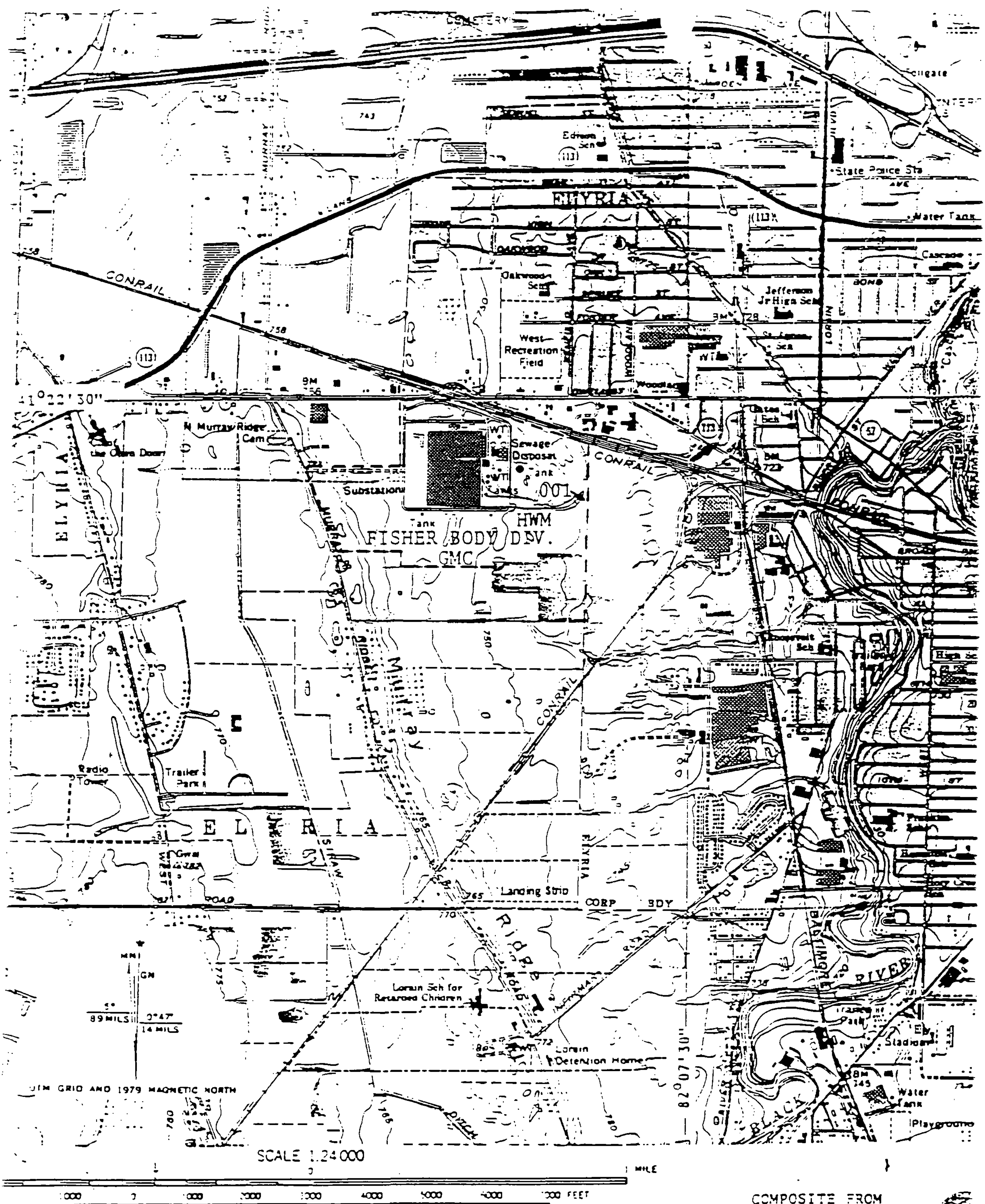


Figure: 1

FISHER BODY DIVISION
GENERAL MOTORS CORPORATION
ELYRIA, OHIO

COMPOSITE FROM
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
AVON, GRAFTON, OBERLIN, LORAIN
QUADRANGLES

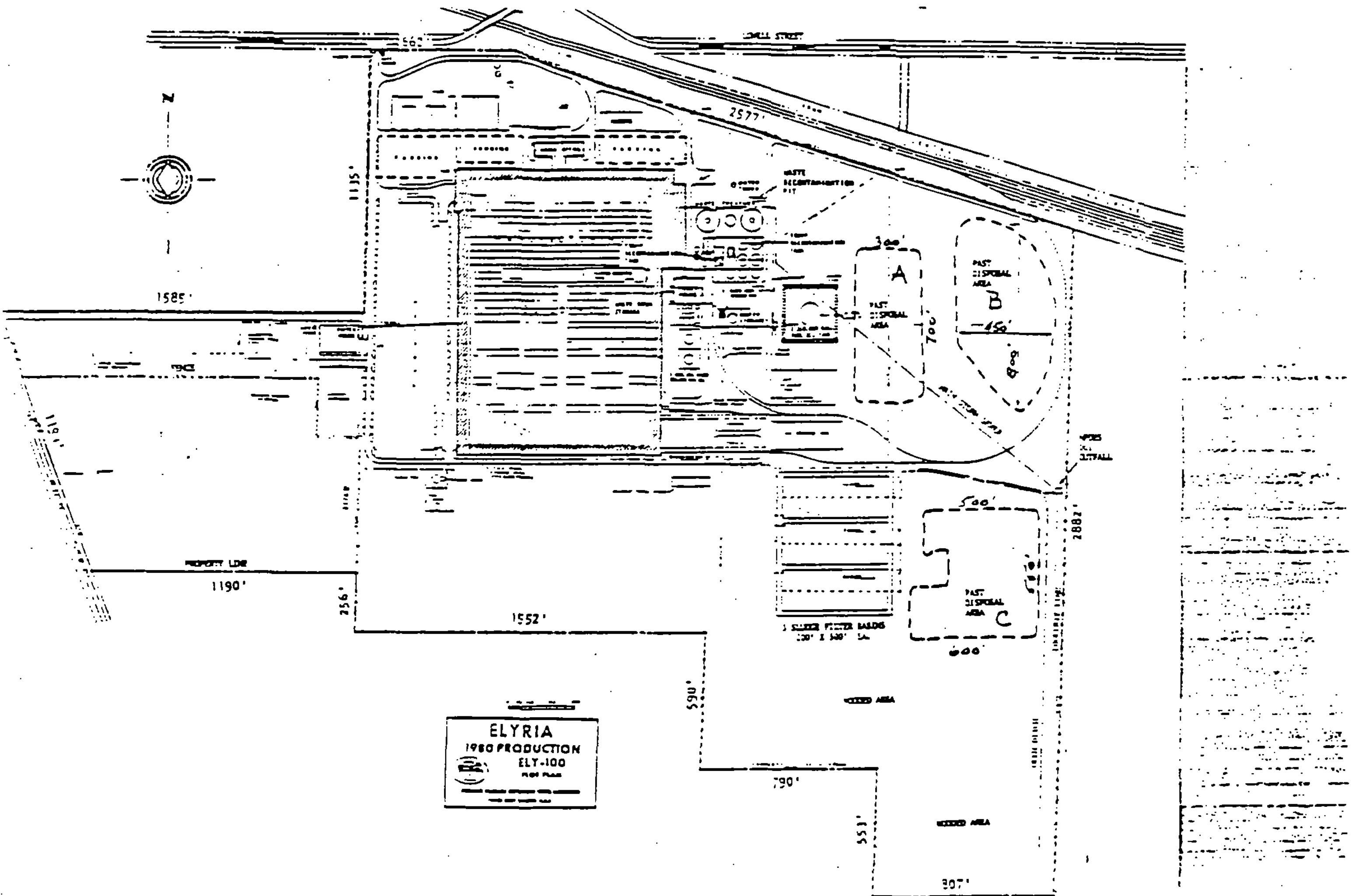


Figure 2: Facility Site Plan

*Source: 1987 CME

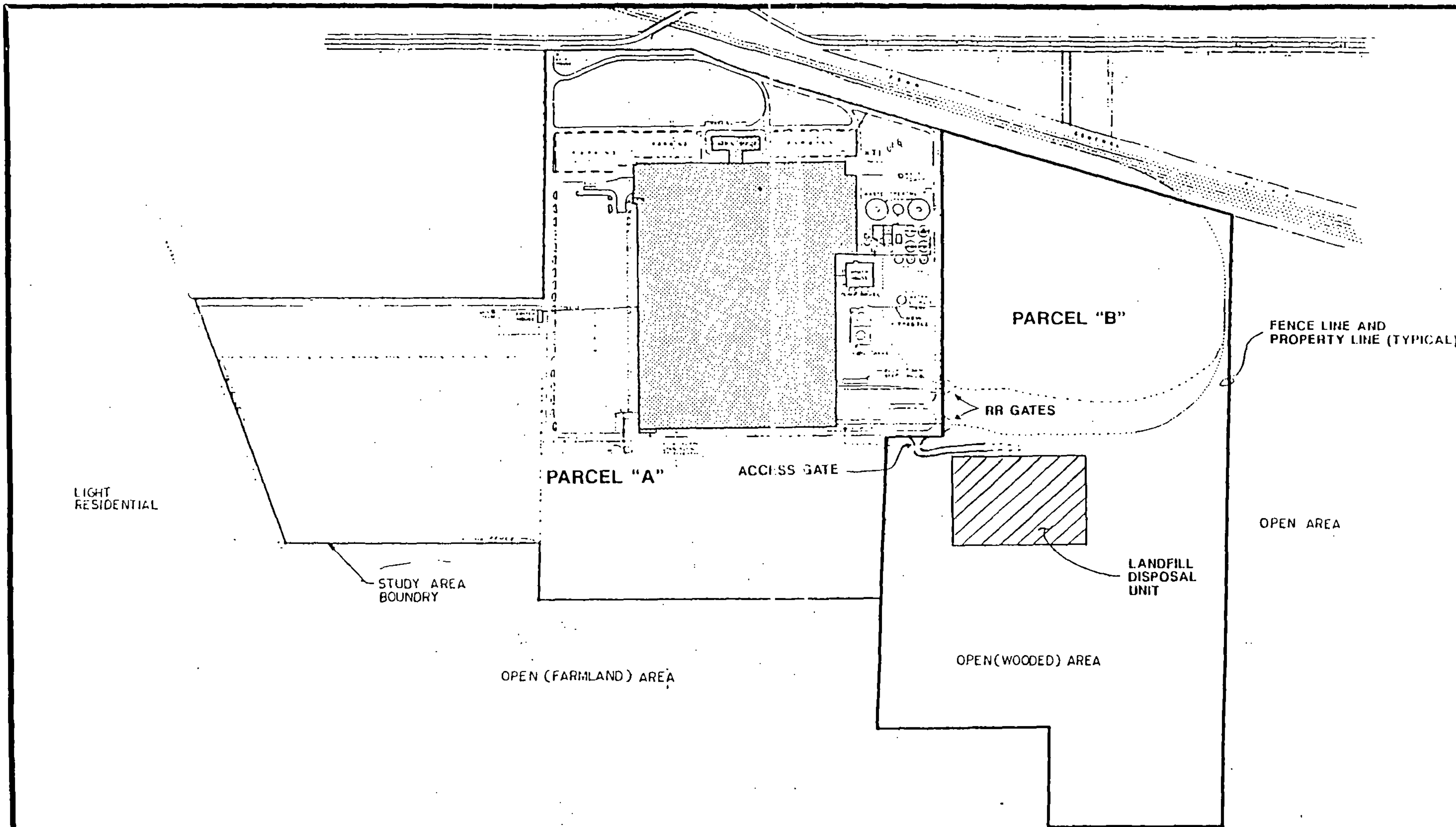


FIGURE #3 General Site Layout, Fisher Guide, Elyria Ohio Facility 11-2-88

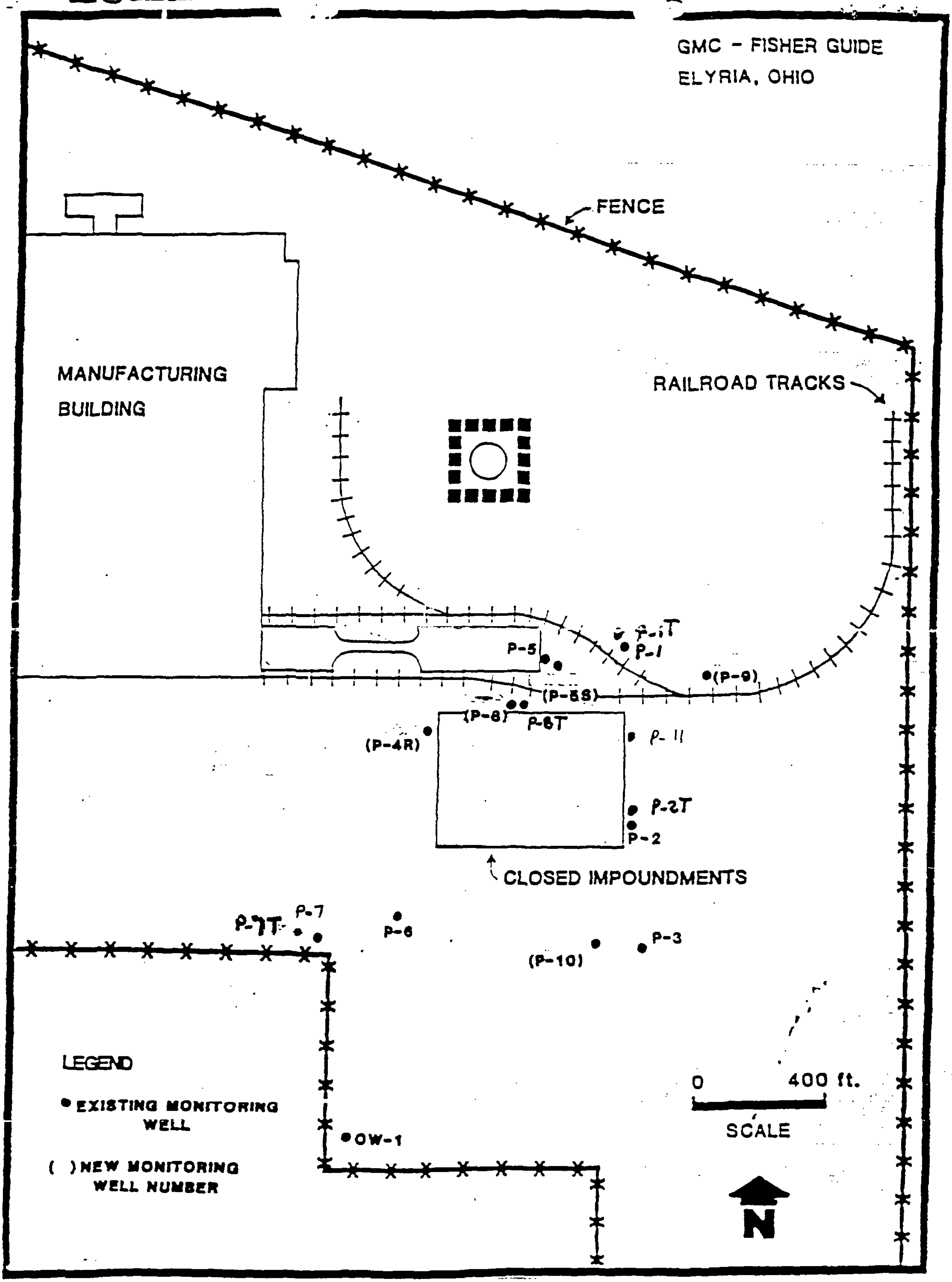


FIGURE 4 - MONITOR WELL LOCATION MAP
"AND RENUMBERING OF WELLS"

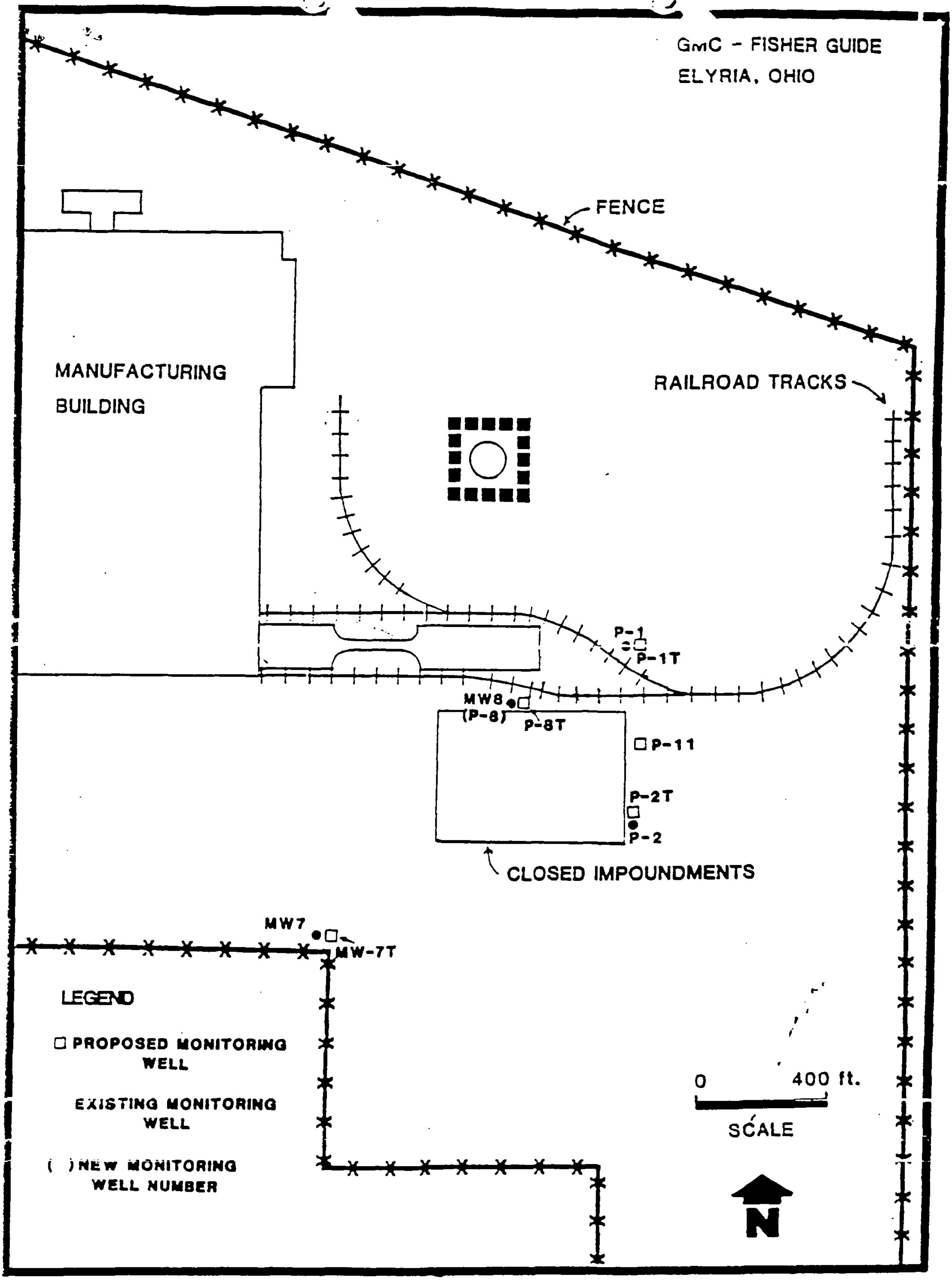
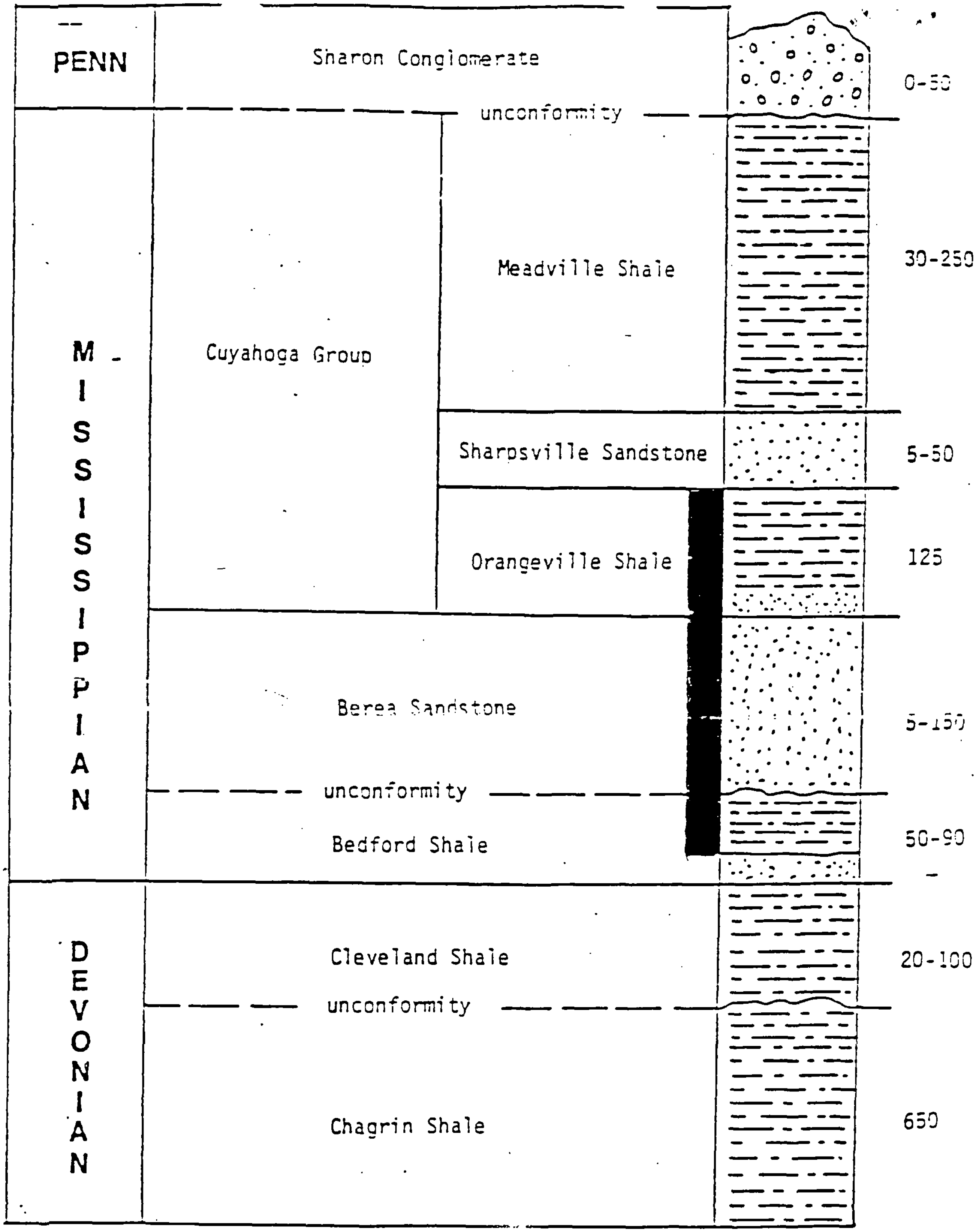


FIGURE 5 - PROPOSED MONITOR WELL LOCATION MAP
FOR SHALLOW" WELLS



UNITS ENCOUNTERED IN DRILLING PROGRAM

*Source Reference #6

FIGURE 6
PARTIAL GEOLOGIC COLUMN FOR LORAIN COUNTY

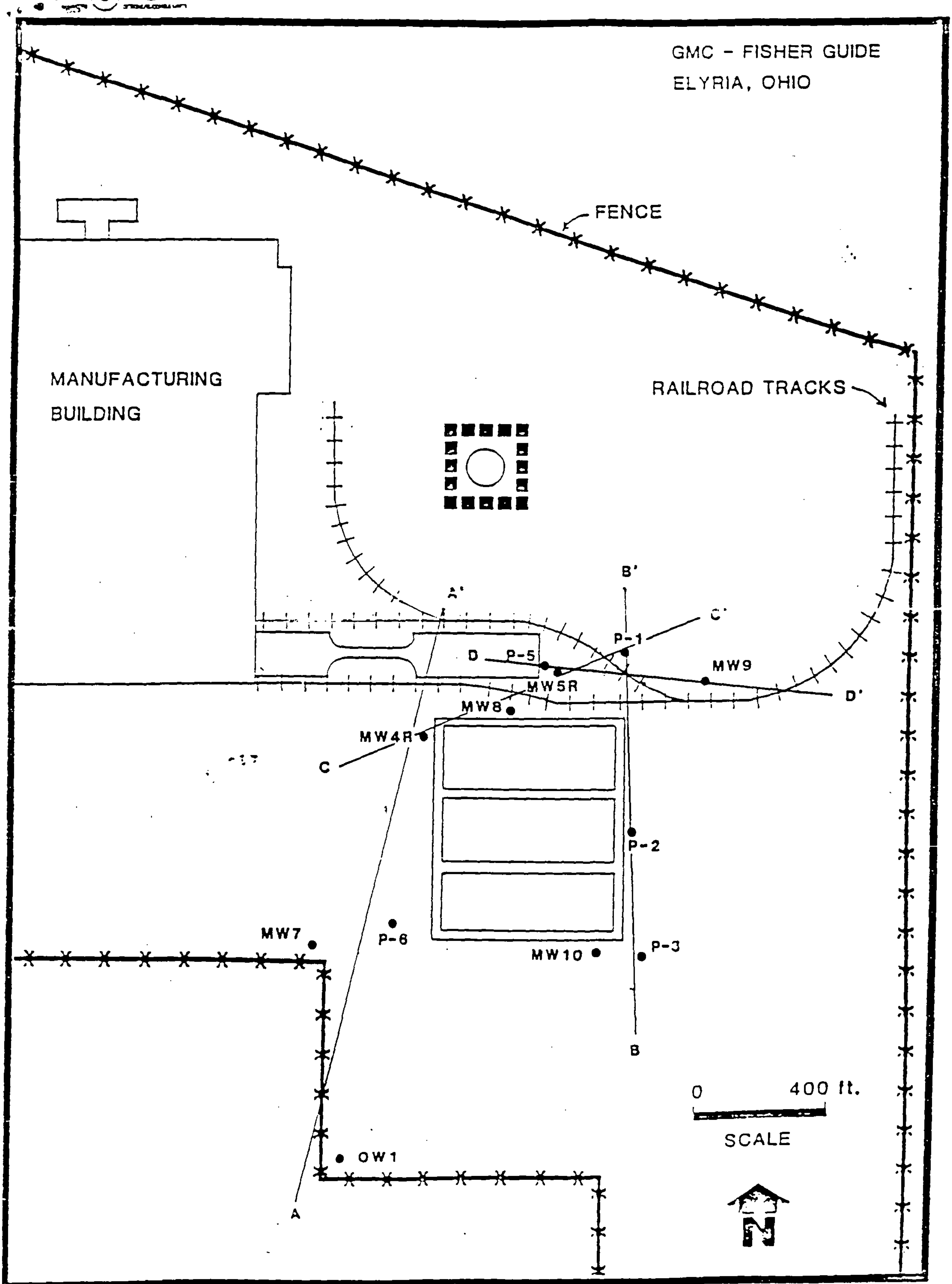


FIGURE 7 CROSS SECTION LOCATIONS MAP

FIGURE 8 GEOLOGIC CROSS-SECTIONS
GMC-FISHER GUIDE
ELYRIA, OHIO

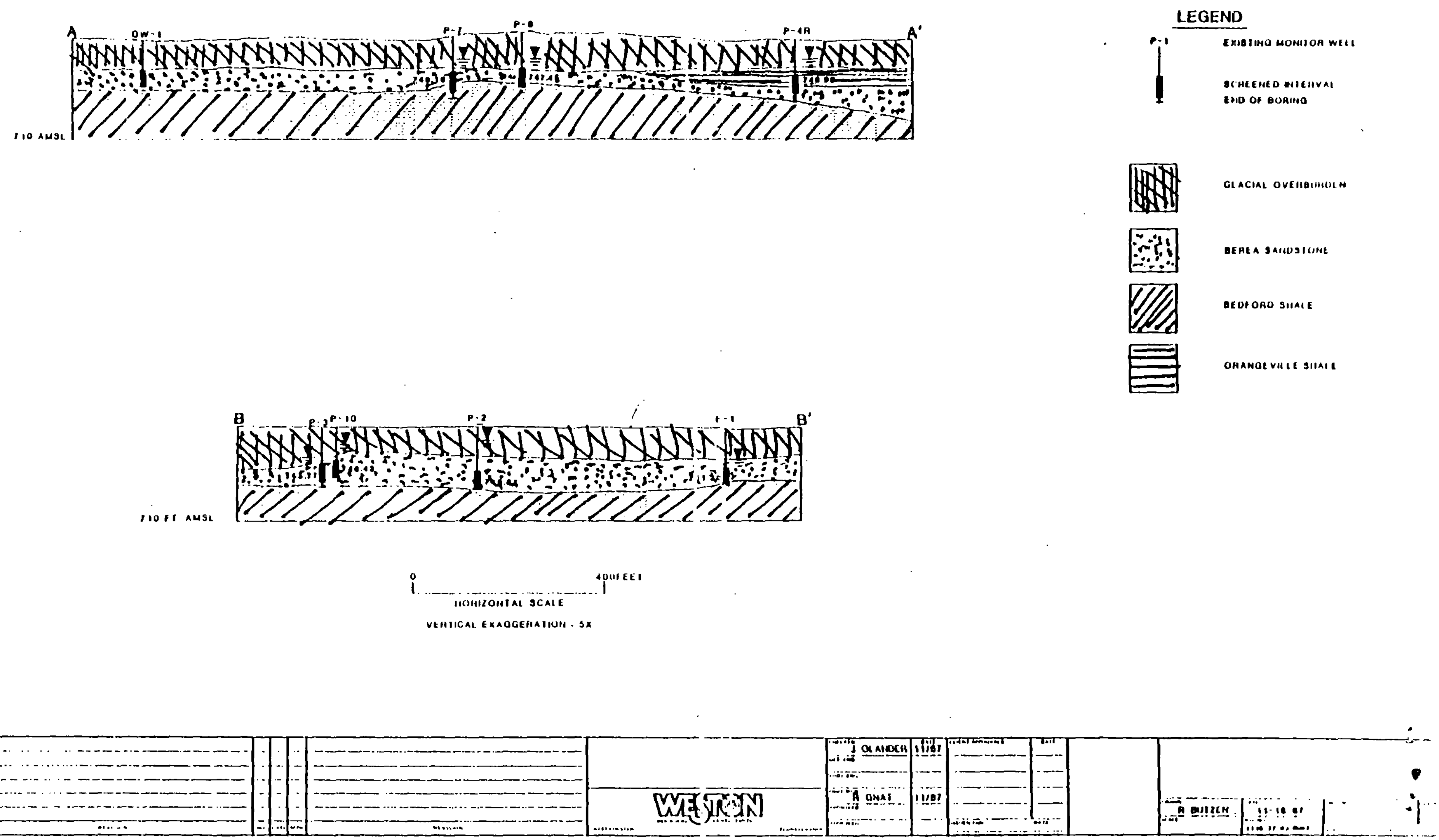
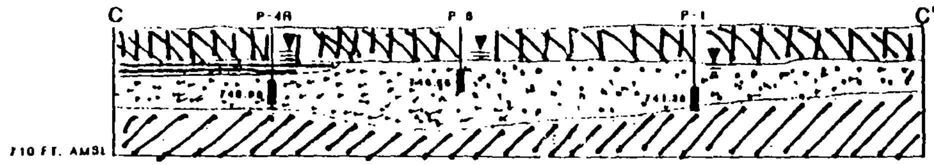


FIGURE 9 GEOLOGIC CROSS-SECTION
GMC - FISHER GUIDE
ELYRIA,OHIO



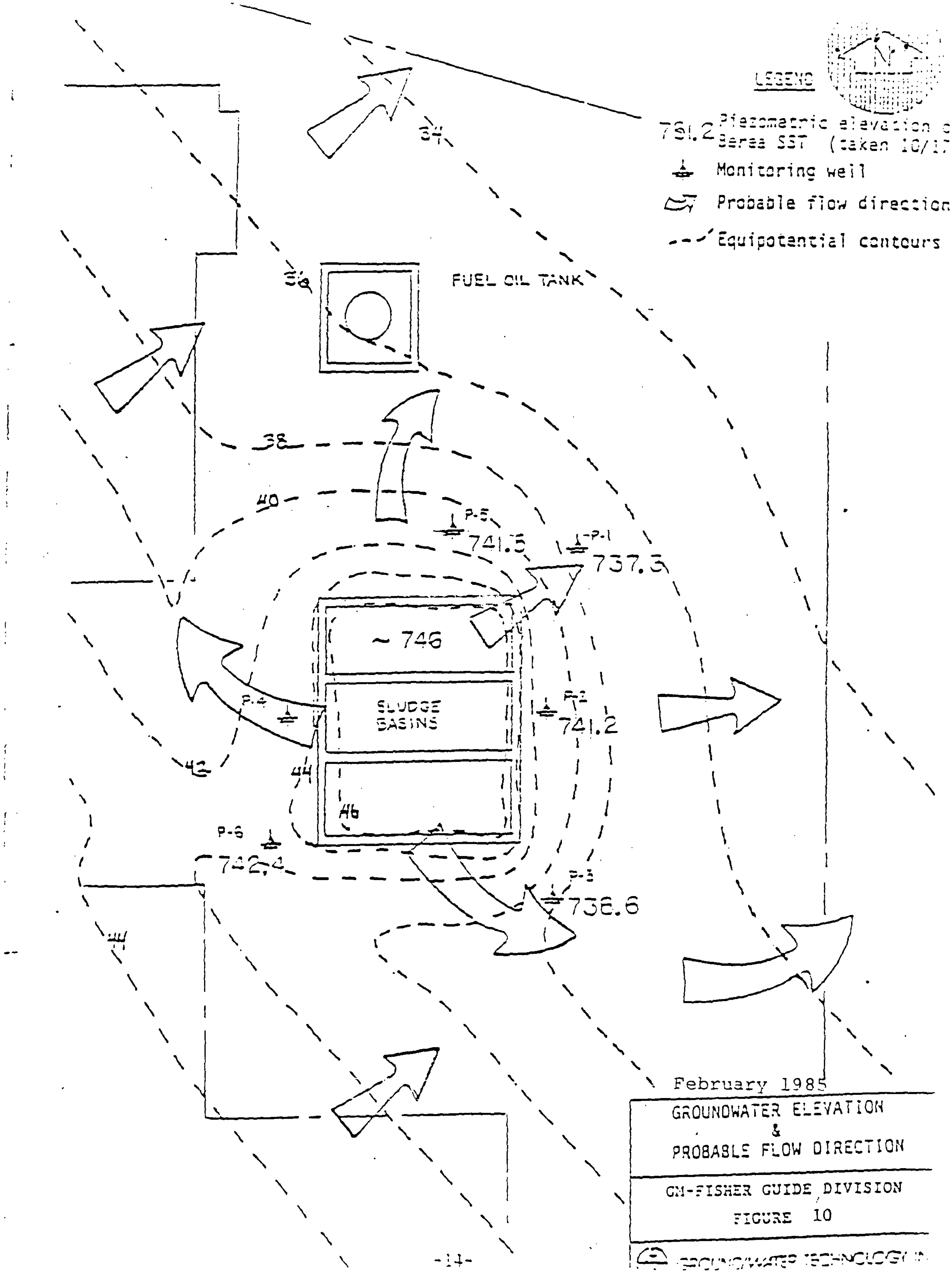
LEGEND

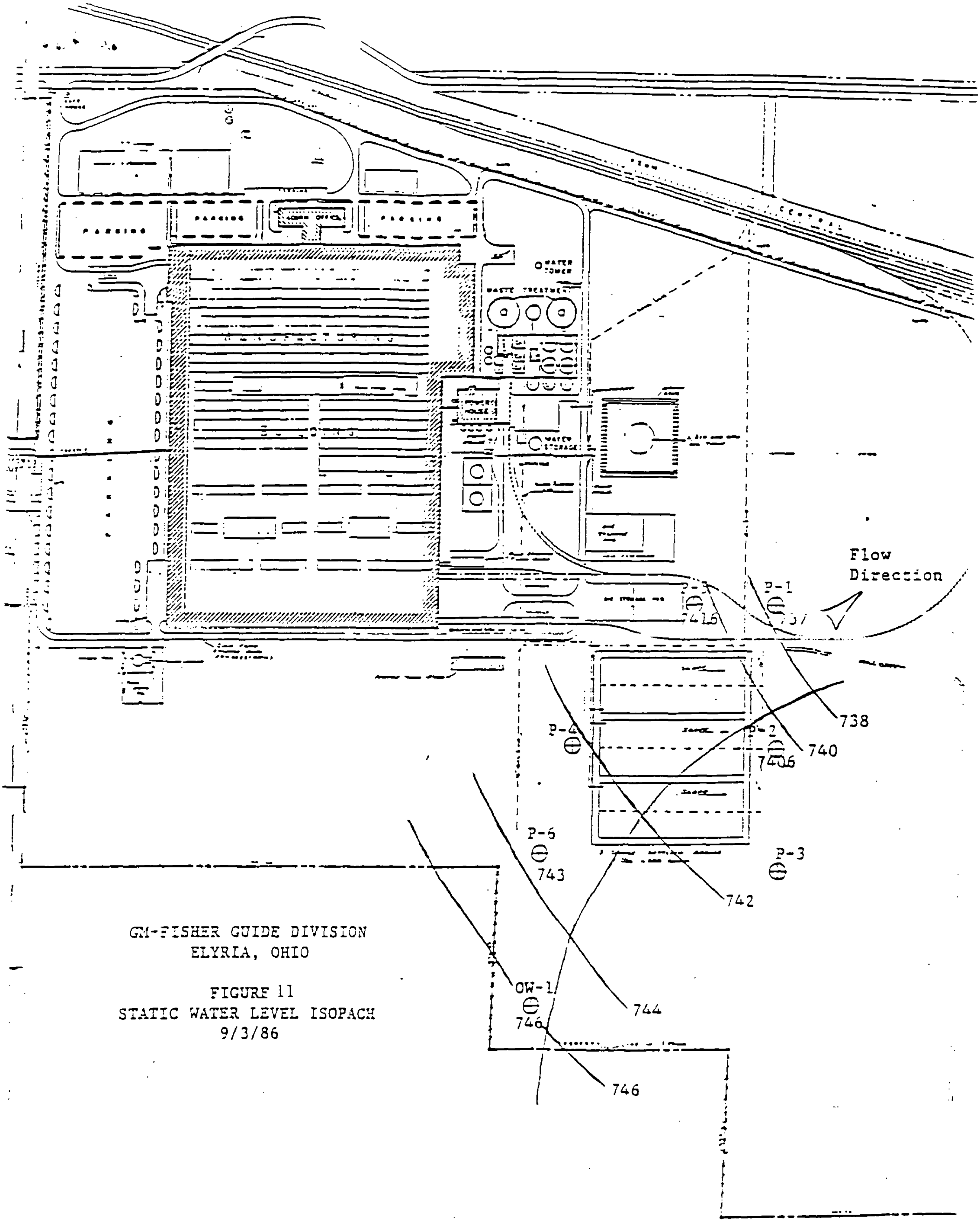
EXISTING MONITOR WELL
SCREENED INTERVAL
END OF BORING
GLACIAL OVERBURDEN
BEREA SANDSTONE
BEDFORD SHALE
ORANGEVILLE SHALE

0 400 FEET
HORIZONTAL SCALE
VERTICAL EXAGGERATION 5X

WESTON

J OLANDER 11/87
R. ONAT 11/87
R. BUTZEN 11 18 87


LEGEND
751.2 Piezometric elevation of Berea SST (taken 10/1?
Monitoring well
Probable flow direction
Equipotential contours
FUEL OIL TANK
34
36
38
40
42
44
46
P-5
741.5
P-1
737.3
~ 746
SLUDGE BASINS
P-4
P-2
741.2
P-6
742.4
P-3
738.6
February 1985
GROUNDWATER ELEVATION & PROBABLE FLOW DIRECTION
GM-FISHER GUIDE DIVISION
FIGURE 10
GROUNDWATER TECHNOLOGY



GM-FISHER GUIDE DIVISION
ELYRIA, OHIO

FIGURE 11
STATIC WATER LEVEL ISOPACH
9/3/86

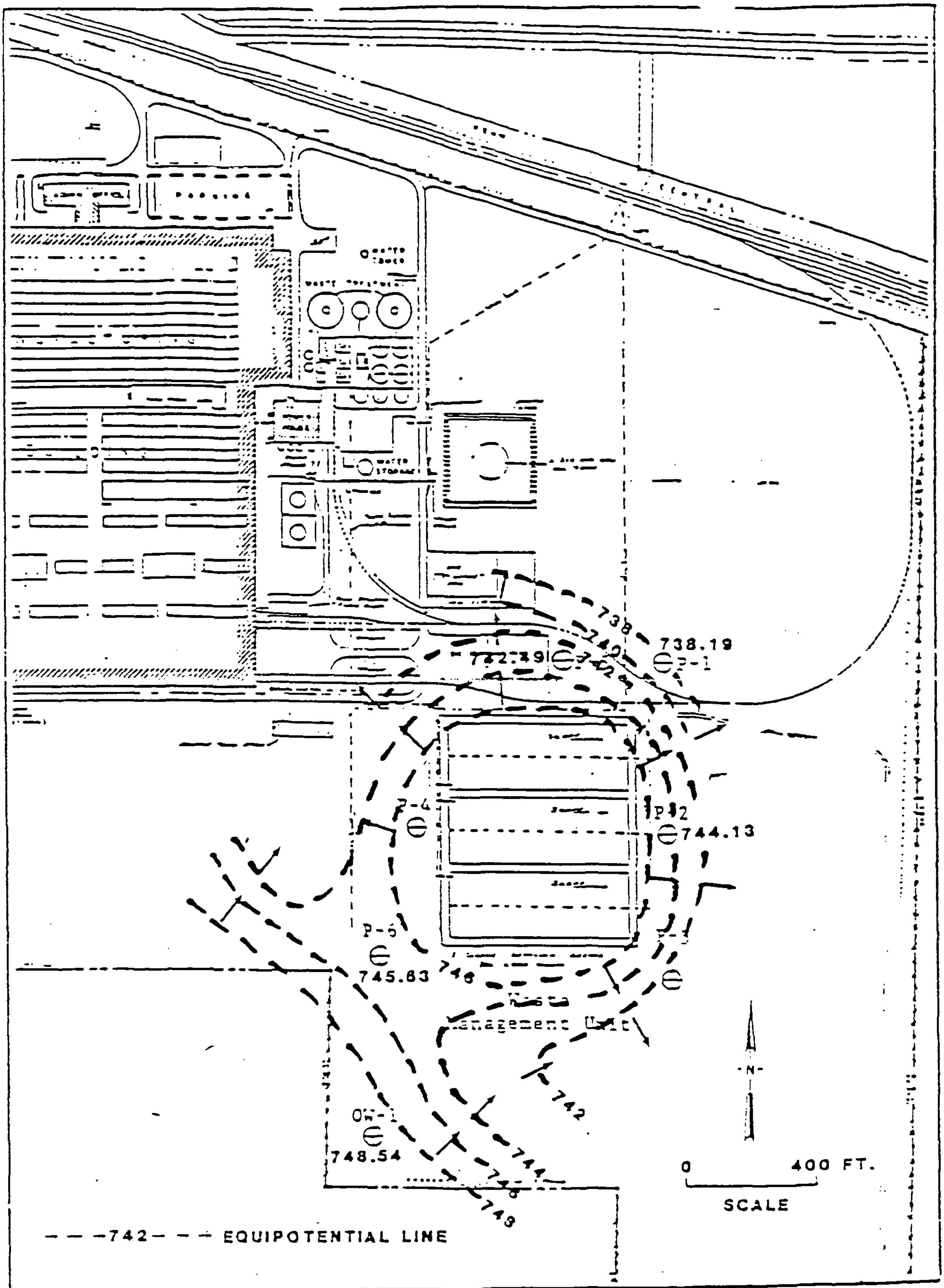


FIGURE 12 - GROUNDWATER CONTOUR MAP BASED ON READINGS OBTAINED IN NOVEMBER, 1986

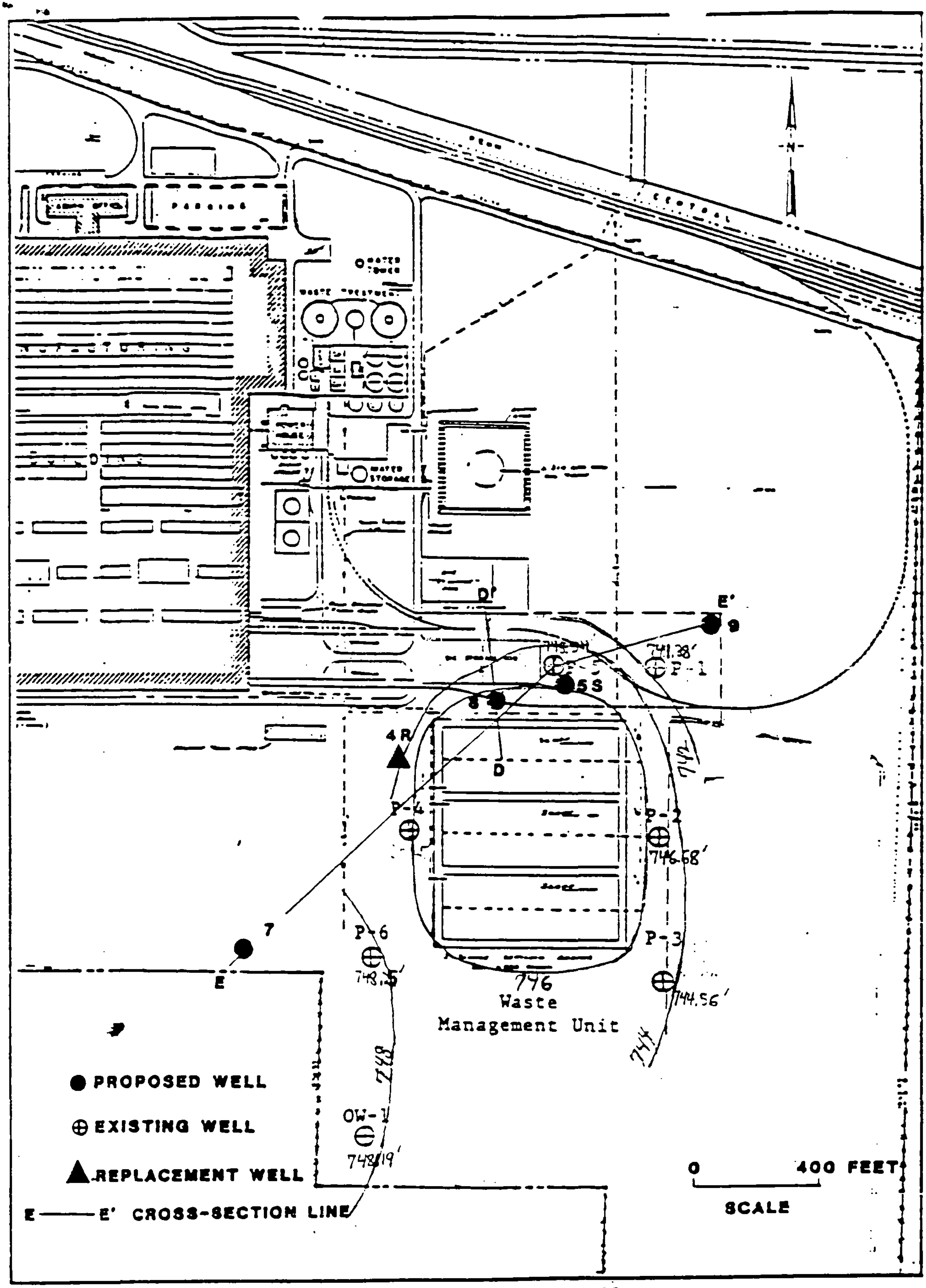
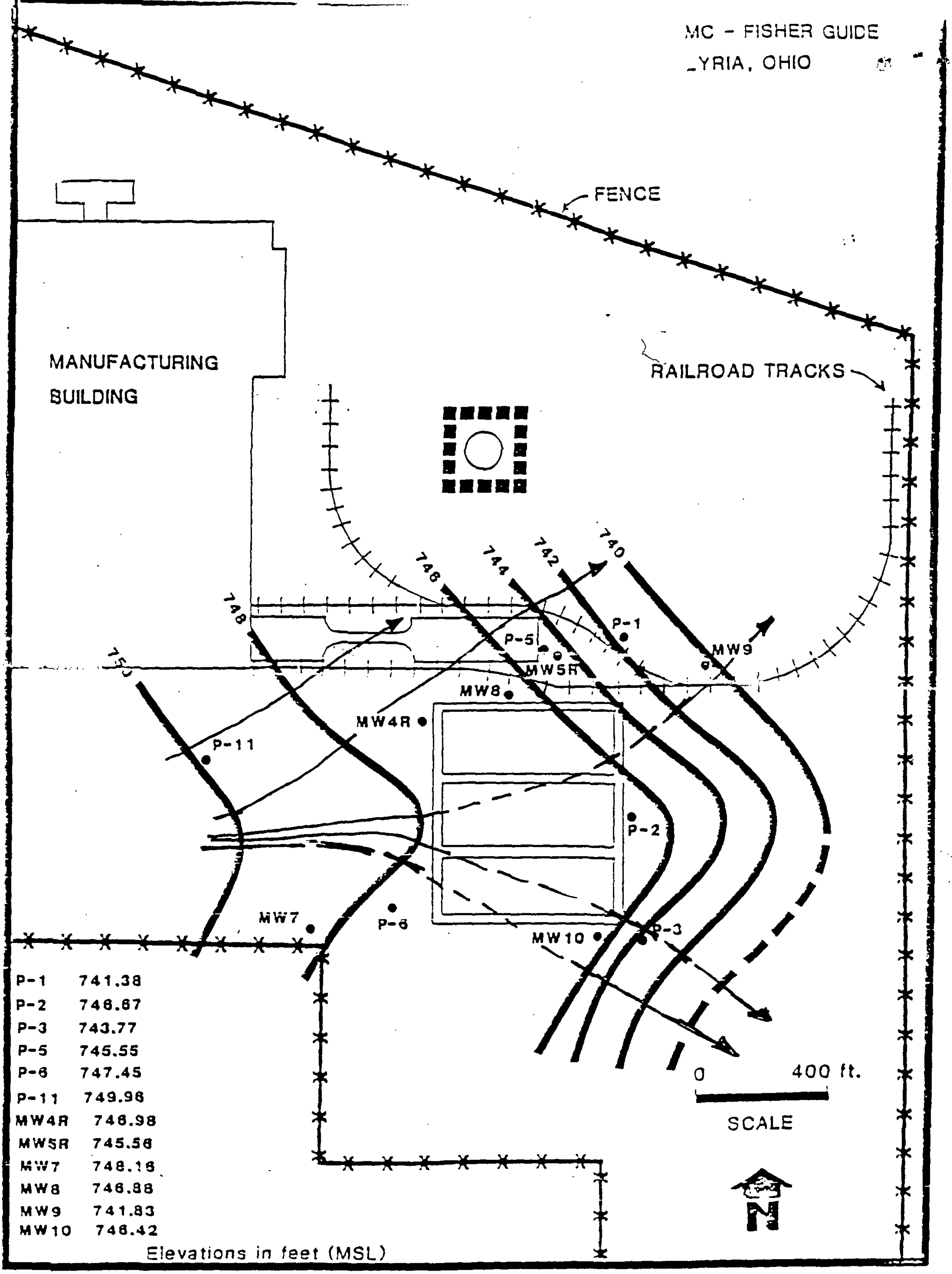


FIGURE 13

Ground Water Contour Map
September 1987



Source: G.W.Q.A.R. December 1987, Flow Direction Lines were constructed by Ohio EPA

FIGURE 14 WATER ELEVATION CONTOUR MAP

September 18, 1987

3-8

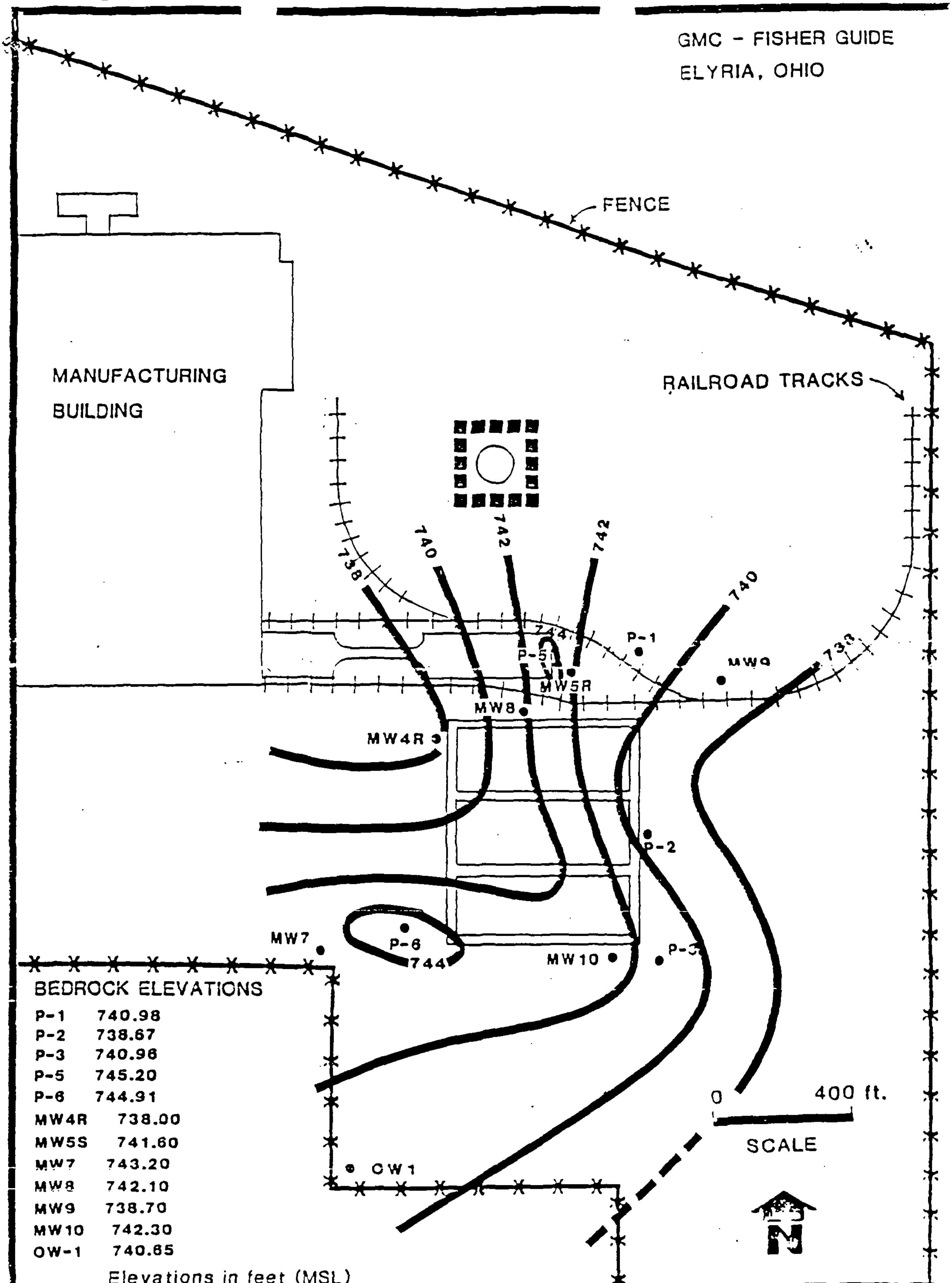


FIGURE 15 TOP OF BEREA SANDSTONE CONTOUR MAP

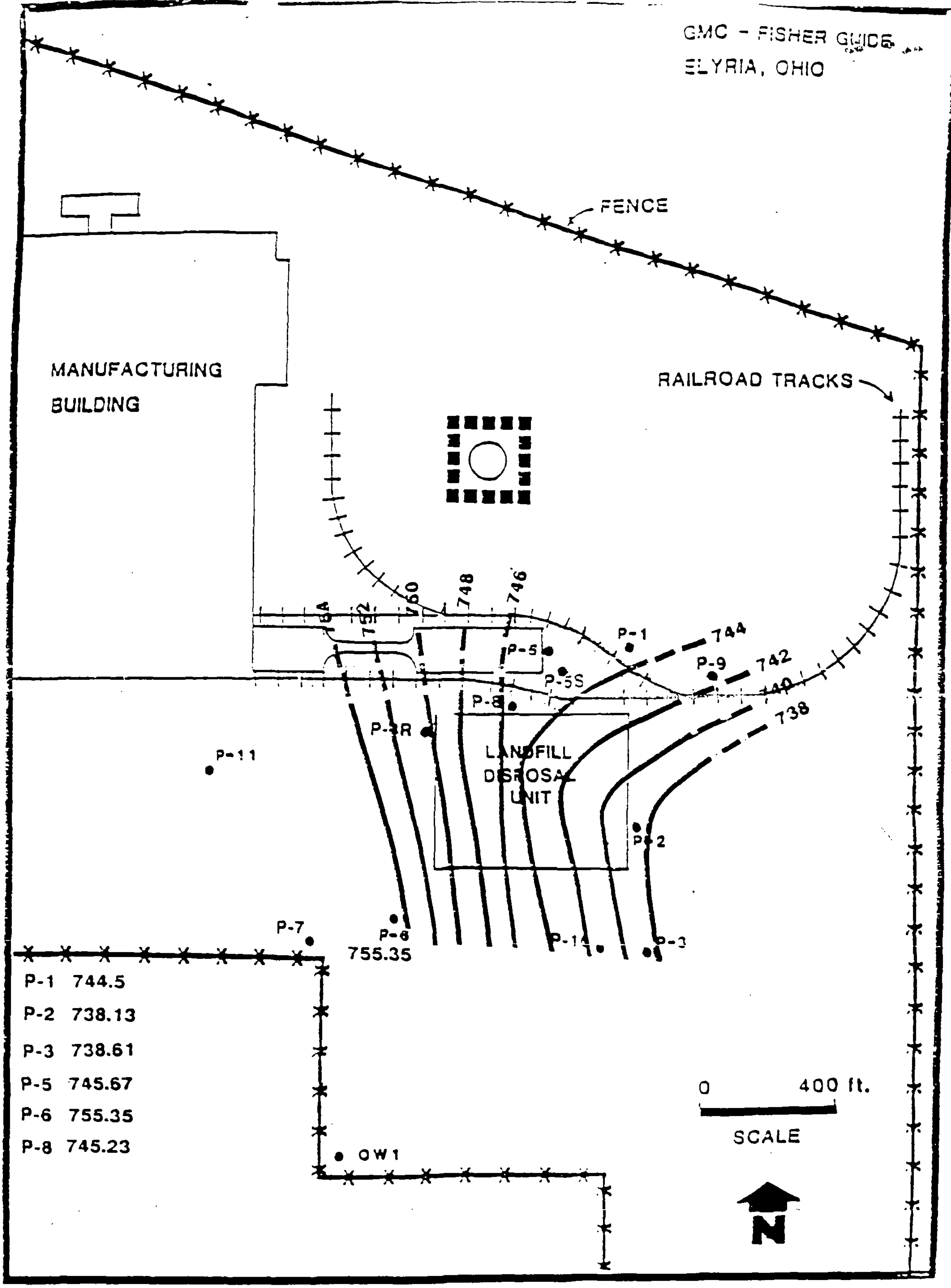


FIGURE 16 WATER TABLE ELEVATION CONTOUR MAP
AUGUST 1988

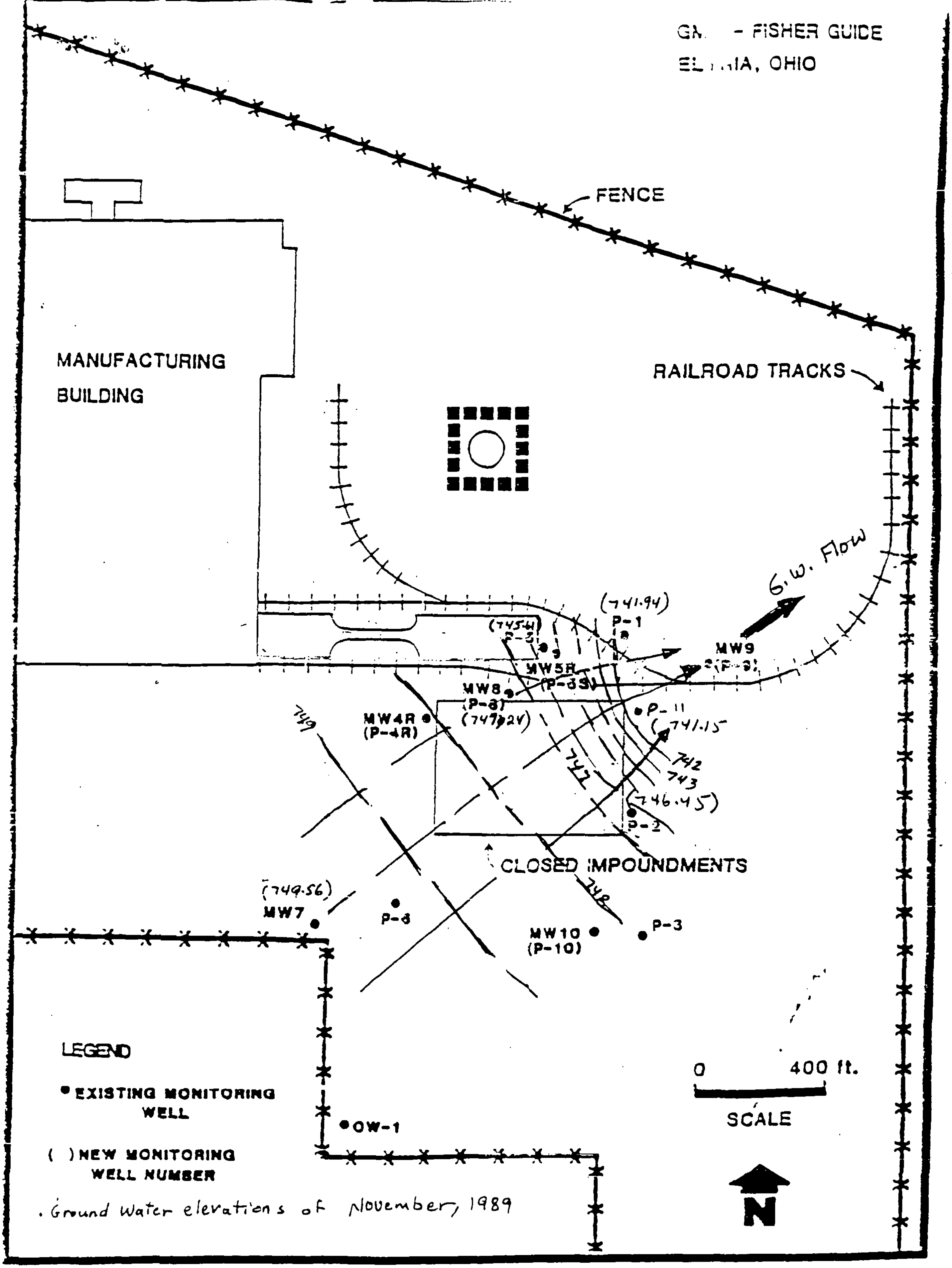


FIGURE 16A - Potentiometric Surface Map for November 1989
Produced by Ahmed A. Mustafa, Ohio EPA

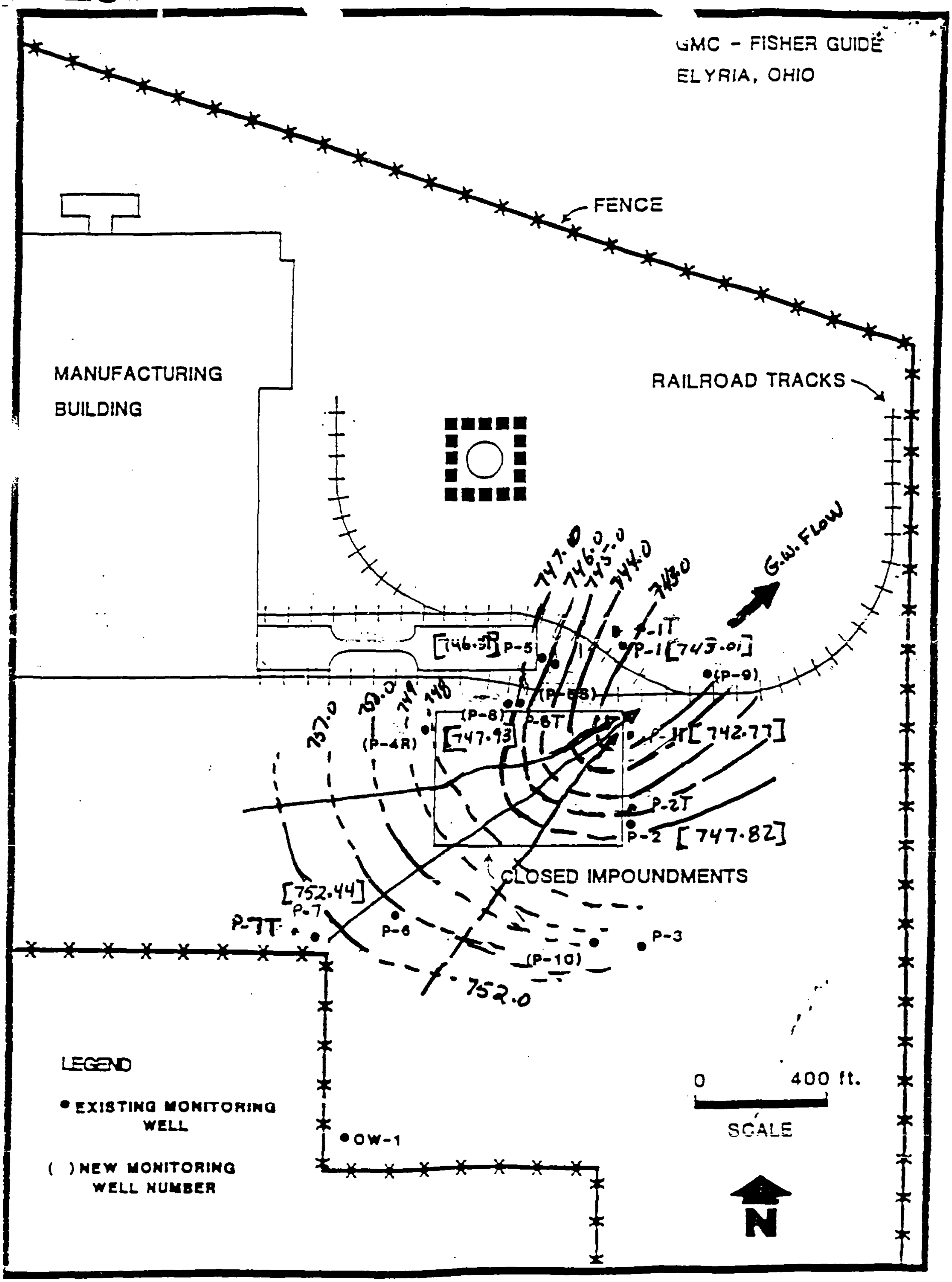


FIGURE 16B: Potentiometric Surface Map for deep wells for Feb. 21, 1990
Prepared By Ohio EPA

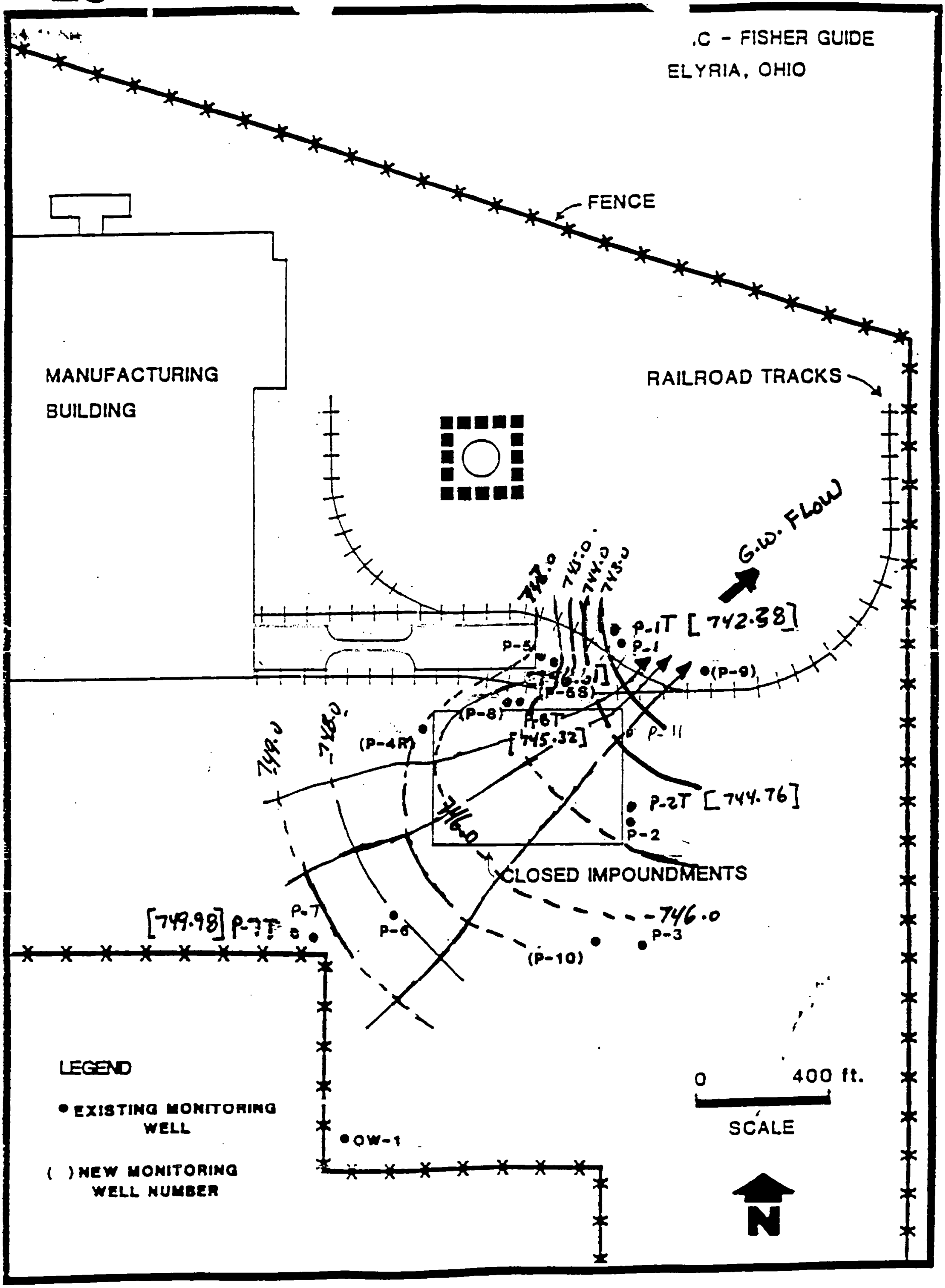


FIGURE 16C: Potentiometric Surface Map for Shallow wells for Feb. 21,1990
Prepared By Ohio EPA

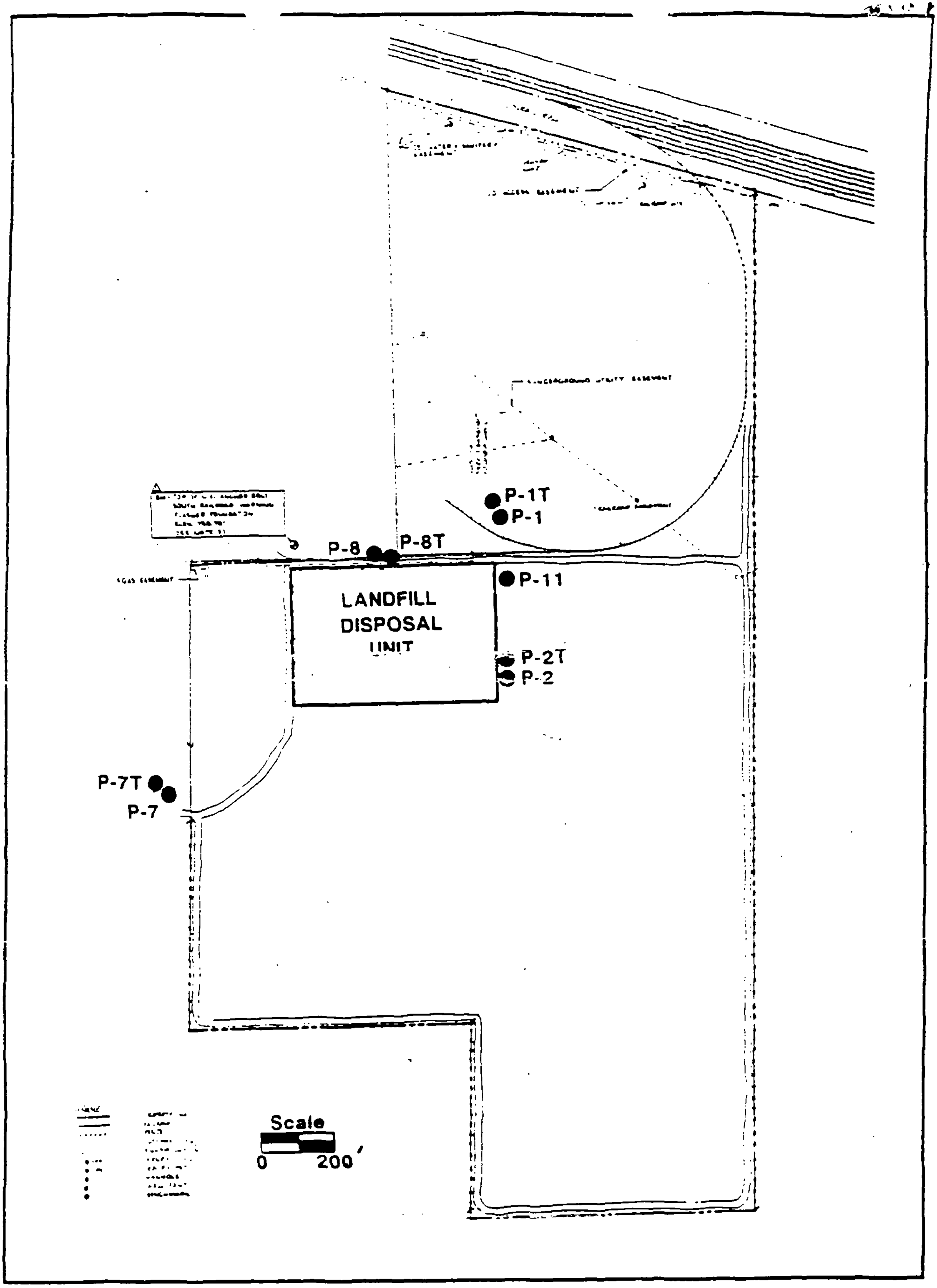


FIGURE 17 PROPOSED MONITORING NETWORK

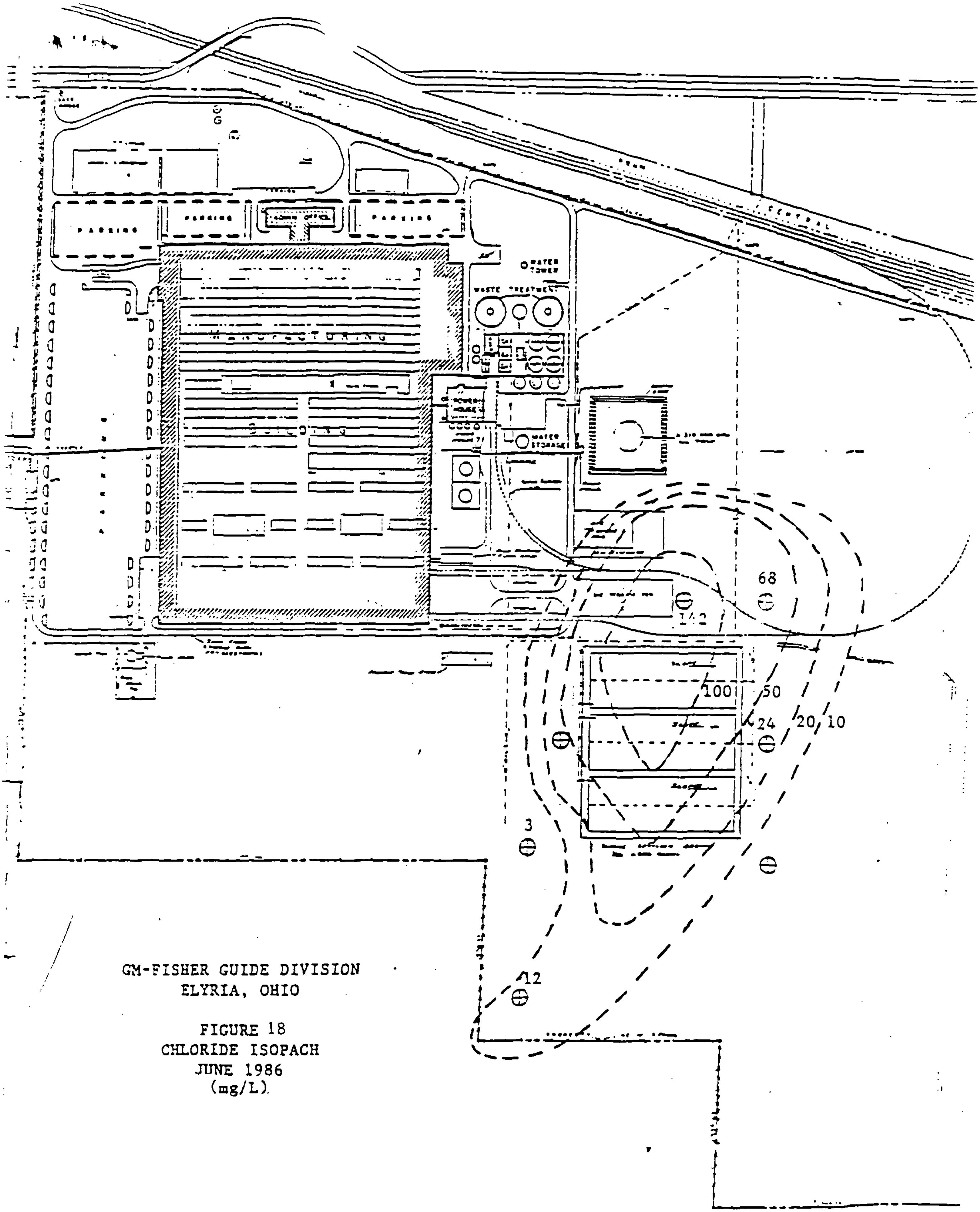


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FIGURE 18
CHLORIDE ISOPACH
JUNE 1986
(mg/L)

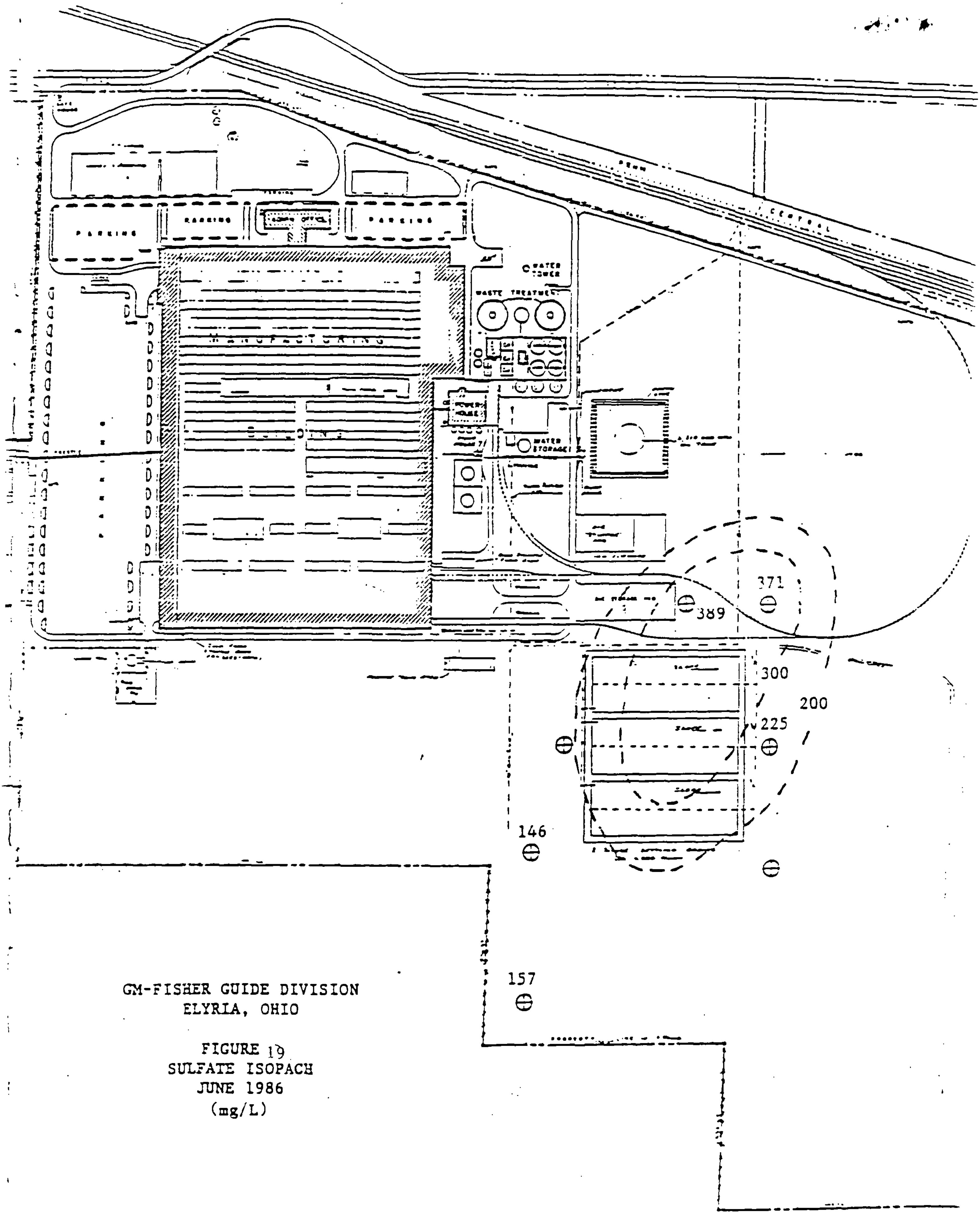

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FIGURE 19
SULFATE ISOPACH
JUNE 1986
(mg/L)

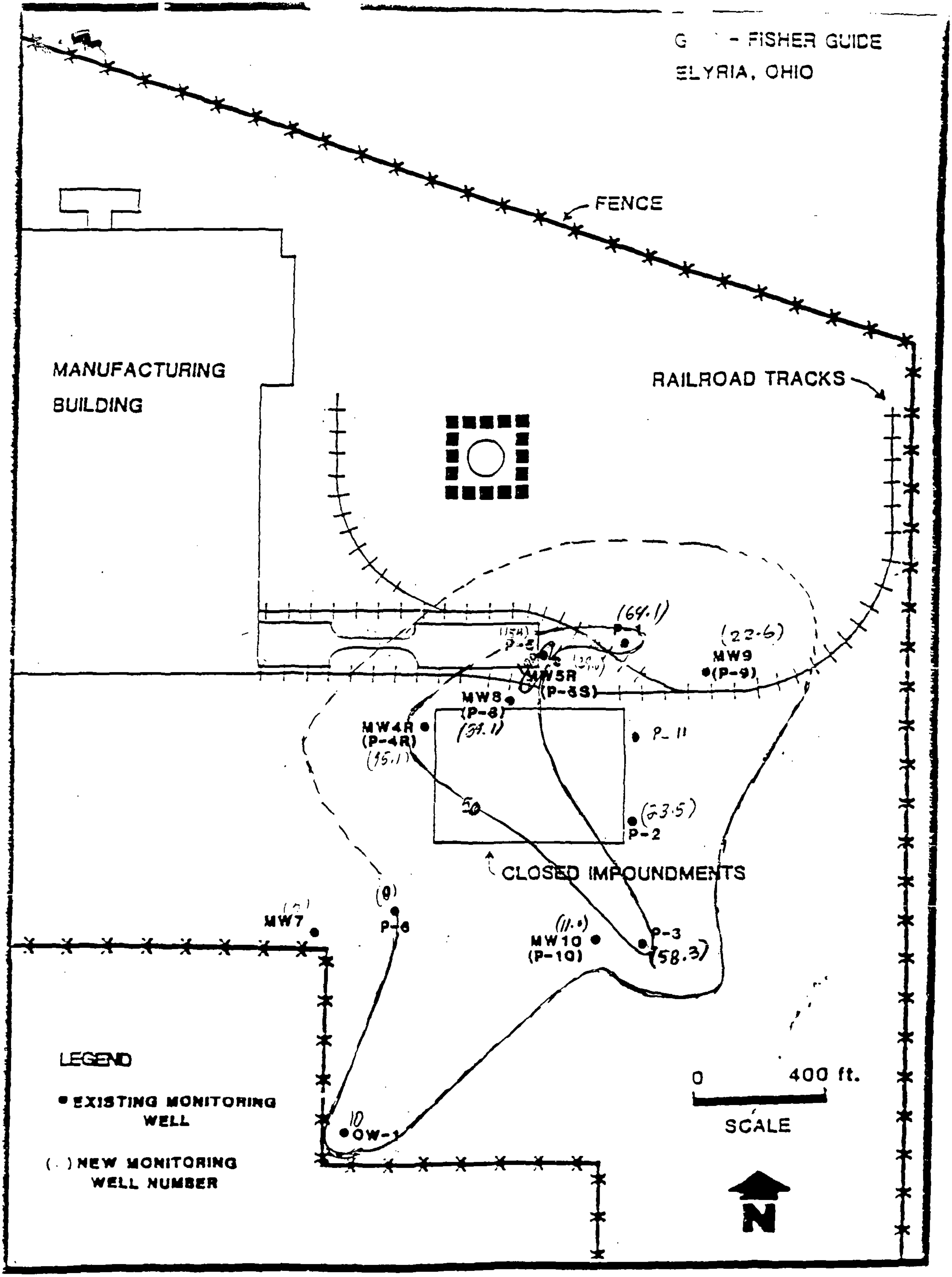

FIGURE 30 - Chloride Isopach, September 1988 (mg/l)
Interval 100 mg/l - GMC Fisher, Elyria,
- Produced by Ohio EPA

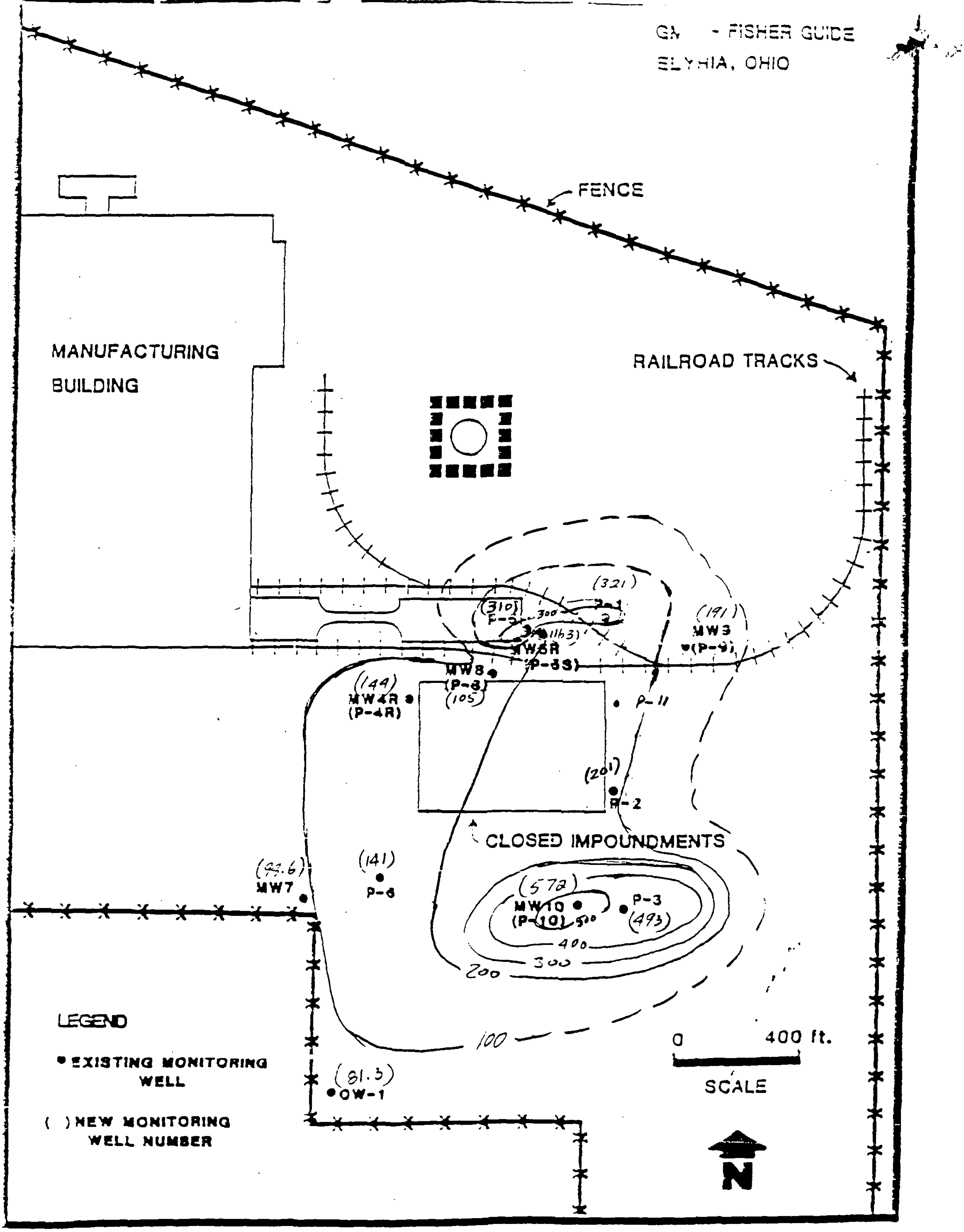

FIGURE 21- - Sulfate Isopach for September 1988 (mg/l)
. Interval 100 mg/l- GMC Fisher, Elyria
- Produced by Ohio EPA